VOL. VI. No. 6. NOVEMBER, 1899.

THE PSYCHOLOGICAL REVIEW.

ON THE VALIDITY OF THE GRIESBACH METHOD OF DETERMINING FATIGUE.[1]

BY DR. JAMES H. LEUBA,

Bryn Mawr College.

In the opinion of many psychologists the results published by Griesbach and his imitators, Dr. Ludwig Wagner and Dr. Vannod, were highly surprising. Experience with the æsthesiometer leads easily to the opinion that, although the ability to discriminate simultaneous touch sensations might very well be altered by fatigue, it would be impossible to measure its influence without taking into account many other factors. That, without regarding these other factors, the dependency of the discrimination sensibility on fatigue could be ascertained safely and easily enough to make of 'the method of Griesbach a practical means of determining and of comparing the degree of fatigue'[2]—a method applicable to the school problem, for instance—went against what many thought to be a legitimate interpretation of their experience.

Griesbach's paper, coming at the timely moment when the fatigue question was the topic of the day in many a teacher's circle, attracted a great deal of attention, and speedily found imitators among teachers apparently delighted to have at last in

[1] The larger part of the experiments here recorded were performed at Heidelberg, Germany, in part in the Laboratory of Professor Kraepelin, and with the improved Griesbach æsthesiometer belonging to the said laboratory. Our thanks are due to Professor Kraepelin for his assistance, and to Dr. and Mrs. Lindley, who acted as subjects during the experiments carried out in Germany, and generally coöperated with the writer.

[2] Wagner's 'Unterricht u. Ermüdung,' p. 112.

hand an easy means of settling the bitter discussion of school fatigue. The results of Drs. Wagner and Vannod confirmed the claim of the initiator, and to-day the method is widely accepted as filling the need of the teacher and of the physician for a comparative determination of fatigue-states.

The writer undertook last winter a series of experiments which were to be the beginning of an exhaustive investigation into the various factors influencing the discrimination of simultaneous touch sensations: the temperature of the surrounding atmosphere and of the parts affected; the blood circulation; the emotional state, etc. As the preliminary measurements clearly contradicted the claims of the authors cited, it was, for several reasons, thought wise to publish them without waiting longer for the completion of a work already several times postponed.

The point at issue in what follows is not so much the correlation of fatigue with discrimination sensibility, as the validity of the æsthesiometric method for the determination of fatigue.

The measurements on which we base our conclusions extended over 14 days and include some 6,000 separate judgments. They were taken at Heidelberg on three persons whom we shall designate by the numerals I, II, III. The writer was one of the subjects; his measurements were taken by Dr. Lindley. To these data, about 180 threshold-determinations were added at Bryn Mawr, involving about 2,000 separate judgments, obtained from six young women students at Bryn Mawr College, by three post-graduate students who had been prepared by a good deal of practice.[1] Dr. Lindley and myself had both worked before with the æsthesiometer; nevertheless, to insure from the start dexterous use of the instrument, tests were taken during two days before record was made of them.

At Heidelberg we used the instrument carefully, guarding as far as possible against the known sources of errors, such as cold spots, momentary hyperæsthesia easily induced, in some persons at least, by focusing the attention on one bit of the skin; the interference of after-images and the partial anæsthesia caused

[1] Miss M. Hussey, Miss G. Locke and Miss N. Wood, to whom I desire to express my thanks.

by too frequent and too rapid touches. We found it necessary to allow about 6 minutes for the determination of the thresholds of one person taken at two places; this included frequent intervals for the skin to return to its normal state. We proceeded as Griesbach had done: the threshold for one and that for two points were successively found for the forehead—along a line running horizontally across the middle of the forehead—and for the ball of the thumb. The place was marked, but we took care to avoid putting the points always on the same spots. The threshold for one point was sought by a gradual decrease; that for two by a gradual increase of the distance between the points of the instrument. Each threshold determination involved usually about eight judgments, sometimes more, especially when after having said 'one,' the subject fell back to two, although the distance had been further reduced. In a case of this kind the figure put on record was the one indicating the longest distance at which the two points were *definitely* felt as one.

In order to draw a parallel between the discrimination sensibility and fatigue, it is evidently not sufficient to have a measure of the former; we should also have a measure of the latter. To establish the discrimination curve and then to interpret its ups and downs in fatigue terms with one's own feeling, or the probable fatigue effect of a lesson in geometry or in singing as the only guide, is evidently a 'pis aller.' If, in this respect, we did not do much better than the investigators in question, we had at any rate the production of fatigue under better control than was the case with the school boys and apprentices tested by them; we could so choose the objects of our attention and so direct it that a relatively constant increase of fatigue took place. Moreover, we were enabled to measure the amount of work done for two half hours daily during six days. This was afforded us by the experiments carried on at the time by Dr. Lindley, experiments in which all three of us participated.[1] They were so conditioned and controlled that the number of

[1] An account of these experiments tending to determine the influence of periods of rest of various lengths on the amount of work performed in a given time, is to be published in Kraepelin's *Psychologische Arbeiten*.

additions performed in the half hour, or in the hour, could be taken as the measure of the mental work done. Unfortunately for us, the limitation of the adding to two daily half hours reduces seriously the value of this control. To submit oneself to the conditions required by such experiments, if they were to last for several hours during three or four days, would be an ordeal beyond the endurance of most men.

In the measurements taken at Bryn Mawr the method pursued was the one used by Wagner: the threshold was gradually approached from two extreme distances, one evidently too great and the other clearly too small; the former distances alternating with the latter. This procedure has the advantage of keeping clearly before the subject's mind the qualitative differences between what he is to call 'two' and what he is to call 'one,' while the other practice delays the recognition of 'twoness' and of 'oneness.'

We begin with the experiments performed at Heidelberg. The three subjects noticed early in the investigation, as other observers had done before them, that the passage from 'oneness' to 'twoness' is through a sensation of length: the touch looses its pointed quality and acquires that of a line gradually stretching until it breaks in the middle, thus producing two spatially disconnected sensations. A similar transformation takes place, but in the reverse order, when the threshold for one is sought. It was therefore agreed to keep answering 'one' however extended the sensation, as long as the break had not occurred.

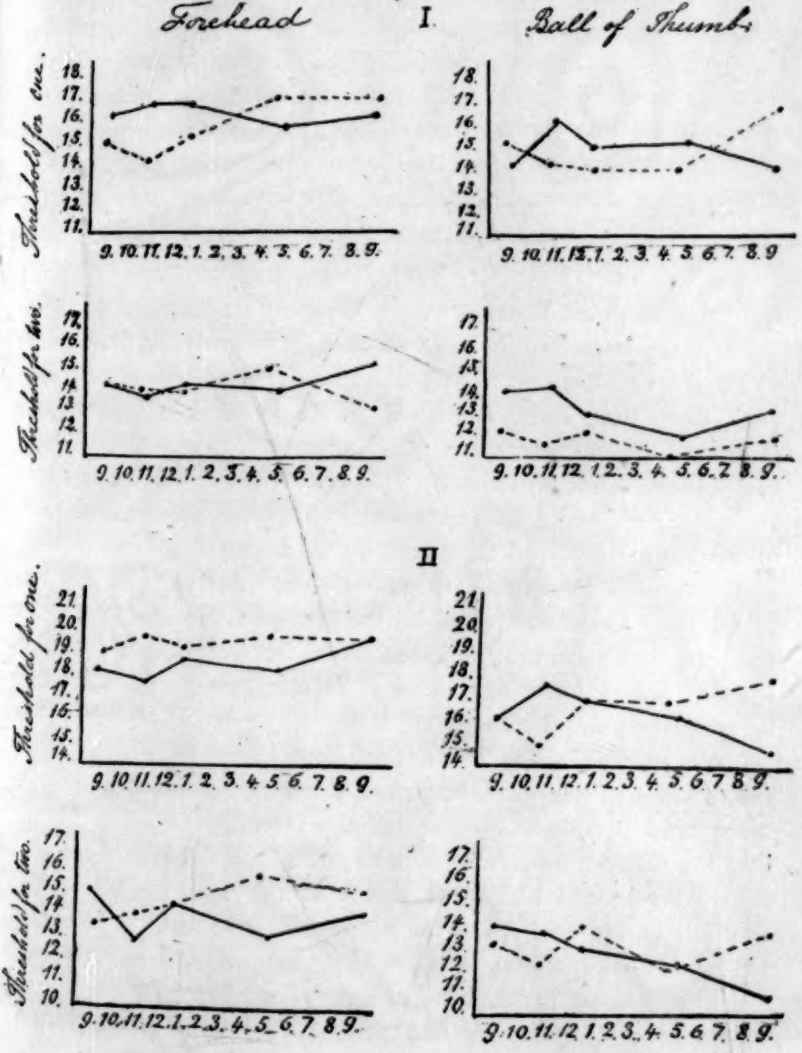
In the following accounts of our experiments we shall, for the sake of directness and concision, refrain from entering into details which, interesting though they might be to the psychologist, do not bear directly upon our immediate object. For the same reason we shall give only as many of the curves we have obtained as appears to us necessary to establish our opinion.

Fig. I will enable the reader to compare the oscillations of the discrimination sensibility during the three days of severe mental work with those having taken place during three days of rest. Each curve is the resultant of three daily curves. The full lines are the rest curves, the dotted ones the fatigue curves. The time at which the measurements were taken is indicated by

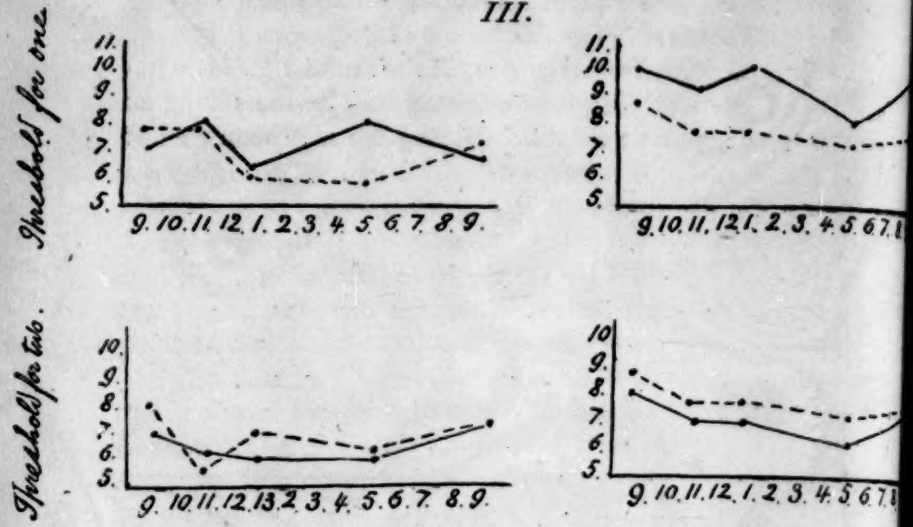
the figures along the axis of ordinates. The thresholds are given in millimeters.

We kept at work from 9 or 9:15 A. M. until 1 P. M. without other interruption than the one occasioned by the taking of the tests at 10:45 or 11 o'clock. During the afternoon we had

Fig. I.



III.



from two to three hours of work before 5 P. M., and we set to work again immediately after an early supper—*i. e.*, from about 7 : 15 or 7 : 30 until 9 : 15 P. M. The subjects kept on working until their time came to be tested. I. spent most of her time reading German literature (Goethe); III. perused books on psychology and philosophy (chiefly Wundt's Grundriss der Psychologie), while II. computed the returns from the experiments before referred to, a task by no means easy. The German language introduced in our reading an additional element of fatigue; Goethe required on the part of I. close attention and induced very soon real fatigue. We did our best all through the day not to allow our mind to wander, even though it cost us frequent painful efforts.

We worked all three in the same room to eliminate the fluctuations of temperature and of blood circulation which would have been produced by the passage from the open winter air into the warm atmosphere of a room. Our life was well regulated; we retired early and nearly at the same hour each day and our coffee and tea drinking was kept as much as possible the same during the six days of experimentation.

The fatigue produced was well marked. The words used to describe it were, for the first day: 'Quite tired; a little

nervous' (III); 'very tired, understand no more' (I); 'worked with energy all day, but could not go on much longer' (II). For the second day: 'Tired' (III); I., who felt very tired before supper, was somewhat excited and disposed to go on when 9: 15 P. M. came; 'very, very tired, tired out' (II). At the end of the third day we were all three quite tired and extremely glad at the prospect of the coming days of rest. The last hour of the morning was usually quite burdensome, not that our work was lacking in interest, but that we were no more able to attend spontaneously; it was already fatigue and not simply nervousness. The reader might wish that we should give the curves for each one of the six days, together with a designation of our fatigue feelings at the moment of the measurements and not only the resultants. If anything more than what can be inferred from the resultant curves could be derived from the separate curves, they would be reproduced here; but it is not the case: the daily curves do not follow the fatigue feelings any better than the resultants.

As each one of us engaged for the whole morning in mental work engrossing his attention and requiring a considerable degree of mental tension and drove himself continuously at full speed, the reader acquainted with Griesbach, Wagner's or Vannod's papers will expect our fatigue-curves to ascend more or less regularly from 9 A. M. to 1 P. M. The ups and downs of the curves of these investigators due, according to them, to the different degree of difficulty presented by the lessons, some of them being hours of relaxation, could not be expected in our case. At 5 P. M. the curves should not be found much, if any lower than at 1, the after-dinner rest being offset by from two to three hours of work; and we should expect them to reach the highest point at 9: 15.

Concerning Fig. I the following points are to be noted:

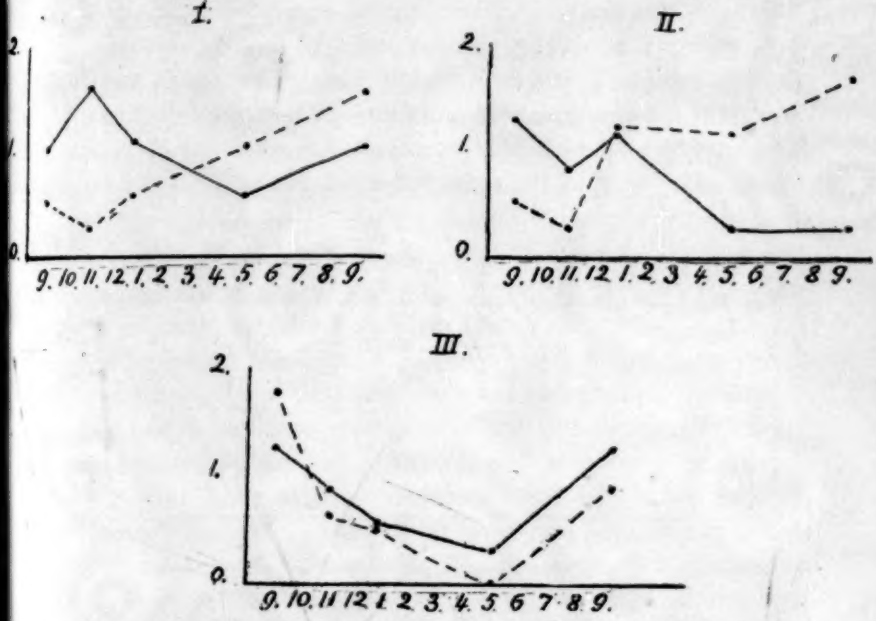
1. The vertical extremes between which the fatigue-curves wander remain very near together. For II. the distance between these limits goes once beyond 3^{mm} and reaches that figure three times only; for I. it never reaches 3^{mm} and four times only does it go beyond 2^{mm}, while for III. it exceeds 2^{mm} only once and then just by a fraction of a millimeter.

2. A striking and not to be expected lack of agreement between the curves for the two-threshold and those for the one-threshold. Concerning the four pairs of curves of I., only the thumb fatigue-curves agree tolerably well with each other, as the reader will see. With III. the fatigue and also the rest-curves for the thumb agree fairly well, but those for the head show more frequently opposite directions. The tracings of II. may be called satisfactory in this respect.

3. The corresponding forehead- and thumb-curves agree still less; neither in the tracings of I. nor in those of II. is there any general agreement to be found; on the contrary, the curves are on the whole the opposite of each other. III. distinguishes himself in that he shows two pairs of curves in agreement: the fatigue-curves of the one-threshold and the rest-curves of the two-threshold.

4. A comparison of the fatigue- with the rest-curves does not bring to light any general, decided tendency. The oscillations of the rest-curves are about as great as those of the fatigue-curves, although Griesbach states that "the sensibility under normal conditions [he means no fatigue] changes not at all or only very little." Sometimes the rest-curve ends higher above its beginning than in the case for the corresponding fatigue-curves; sometimes they follow each other almost parallelly. If we draw total average curves summarizing for each subject the four rest- and the four fatigue-curves, we get the tracings of Fig. II, in which the oscillations are so much reduced that we had to increase four times the scale of the drawing. The distances between the vertical extremes of each curve, expressed in millimeters, are as follows: for rest, 1 (I), 1 (II), $\frac{15}{16}$ (III); for fatigue: $1\frac{1}{4}$ (I), $1\frac{3}{8}$ (II), $1\frac{3}{4}$ (III). If we compare in each line the starting with the ending point, we find two of the rest-curves (I and III) ending exactly where they began and one (I) ending 1 mm. below; while of the fatigue-curves two end higher and one lower: + 1 mm. (I), + $1\frac{1}{8}$ (II), − $\frac{7}{8}$ (III). If we consider only the morning part of the tracings, we find that concerning I. two of the rest-curves end higher than they start, one ends at the same level and the other lower; while of the fatigue-curves two end lower, one at the same level and one higher. Concern-

Fig II.
Resultant curves computed from Fig I.



The scale in Fig. II. is four times larger than in Fig. I.—*i. e.*, four squares, instead of one, stand for one millimeter.

The starting points of the curves of Fig. II. have been arbitrarily determined.

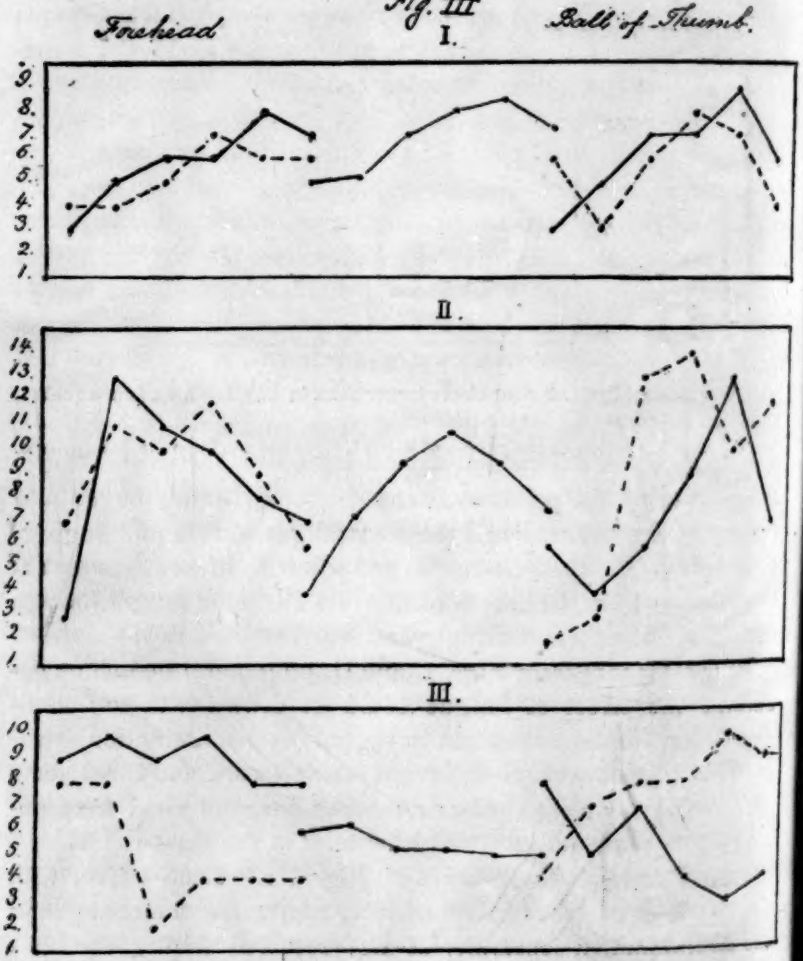
ing II., two of the rest-curves end higher than they began and the two others lower, while the four fatigue-curves end higher. Concerning III., the rest-curves end lower in three cases and at the same level in the fourth one, while the four fatigue-curves end *lower* than their starting point.

It is clear that from Figs. I. and II. no general deduction regarding the effect of fatigue could be drawn with any confidence, and yet the curves put in regard the discrimination sensibility during three days of severe mental work and three days of rest. If the æsthesiometric method does not yield here unambiguous results, how could it be used in the class-room?

Let us pass to the curves of Fig. III. Each curve, with the exception of those in the middle, represents the changes in the discrimination sensibility as they occurred during one hour

of adding performed on five successive days. The distances from one point to the next, measured vertically, indicate the modification of the sensibility during one hour of adding. The hour was divided in two halves separated as follows: 1st day, no rest; 2d day, 5 minutes rest; 3d day, 15 minutes; 4th day, 30 minutes; 5th day, 60 minutes. The continuous lines represent the one-threshold; the broken line, the two-threshold. The curves in the middle are each the resultant of the four others belonging to the same subject. No value is to be given

Fig. III



to the position of the starting-point of the segments as, in order to get a curve, the end-point of one day was used as the beginning of the next.

Concerning Fig. III, we notice that: 1. As in Fig. I, the one-threshold curves agree only occasionally with the two-threshold curves. Compare, for instance, the thumb-curves of III. Those agreeing best are the forehead curves of II., and even then one of them indicates a decrease of sensibility during the adding of the third day, while the other shows an increase.

2. The agreement of the head- with the thumb-curves is no better than previously. In the case of II. and of III. the divergences generally reach opposition. In I. the one-threshold curves exhibit a noteworthy concordance.

3. Regarding the relation between fatigue and the sensibility, we have in the addition returns a means of measuring fatigue, and consequently of controlling the results yielded by the æsthesiometric method, which, if not absolutely reliable, is at any rate of some value. We should not take it for granted, even though we could assume that the initial psycho-physiological state of the subject was each day the same, that the degree of fatigue varies in inverse proportion to the length of the rest-period separating the two half-hours of work. The amount of work actually performed will be a much safer index of the fatigue increase. But can we accept the statement that the greater the amount of work, the greater the fatigue; and that, as far as the adding periods are concerned, all the work done is represented by the number of additions; and can we consequently assume that the fatigue increase bears, in the same person, a constant relation to the number of additions performed? Man is a too complex and not well enough unified machine for such an assumption to be true. Coexistently with the physiological activity involved in adding, many other processes take place equally efficient as modifying factors of the body metabolism, but not constant enough to constitute a fixed quantity. The muscular tensions which vary so much from one time to the other will, for one, contribute their share towards the fatigue increase and at the same time tend to bring about a reduction in the amount of the mental work performed. The

number of additions will not even represent the whole product of the physiological activity having a conscious correlate; the adding process is at times accompanied, at other times interrupted, by trains of thoughts and feelings varying greatly, from day to day, in duration and vividness. This supplementary mental work, the adding does not record; or if its effect is perceivable in the number of additions, it is as a *decrease* that it reveals itself. Stated in general terms, the objection here formulated is that the number of additions performed during a given time is not the whole of the psycho-physiological activity, and consequently cannot be an exact correspondent of the fatigue increase. Nevertheless it may serve as an approximate means, and therefore we give in the following Table the returns of the adding for comparison with the curves of Fig. III. It is evident that it would be sheer waste of time to compare these figures with the separate curves of Fig. III., as, if they agreed with one of them, they must necessarily disagree with another, since between head and thumb, as also between the one- and the two-threshold there reigns an apparently hopeless discrepancy. The only possible thing would be to make use of the resultants of the four curves of each subject, however slight the confidence deserved by a curve having such progenitors.

A. FOR THE WHOLE HOUR.

I.	II.	III.
2d day −84	− 10.8	− 72.8
3d " +78	+ 17	+145.2
4th " +89	+374.2	−424.8
5th " +64	+ 38.8	+285.2

B. FOR THE SECOND HALF HOUR.

2d day + 12	− 21.4	−101.9
3d " + 94	+ 10.6	+ 83.1
4th " + 59	+234.	−231
5th " +110	+ 49.6	+176.1

C. DIFFERENCES BETWEEN THE FIRST AND SECOND HALF HOUR OF THE SAME DAY.

1st day −103	−148	+122	No Rest
2d " +5	−180	− 9	5m "
3d " +95	−163	+ 12	15m "
4th " +124	− 72	− 26	30m "
5th " +180	+ 66	+ 41	60m "

A gives the differences in the number of additions performed between the day named opposite the figure and the preceding one. For instance, *2d day — 84*, means that during the second day there was a decrease of 84 in the number of additions of the first day.

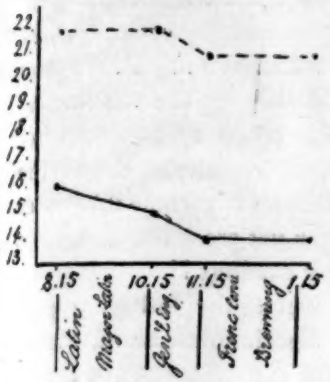
B takes into account only the second half of the hour and *C*, instead of comparing two successive days, gives the differences between the first and the second half hour of the same day. The influence of practice has been eliminated by the deduction of the practice gain. How the practice gain was determined may be ascertained from Professor Lindley's paper, already referred to. The figures of *C* represent, in our opinion, the nearest approach to a successful expression of the changes in the fatigue state, provided they are interpreted as follows: a falling off in the additions in the second half hour as compared with the first is a sign of fatigue; consequently we shall expect the curve to move upward whenever the second half hour yielded less work than the first, and vice versa. How far this interpretation is to be relied upon is not at all clear; but it seems to us the best use we can make of these figures. When construed in this way the resultant curve of subject II. follows remarkably well the figures; and, barring the segment of the first day, that of I. is also satisfactory. But inasmuch as the curve of III. does not at all reflect the oscillations shown by the figures, no general inference can be drawn.

Against *A* and *B*, looked upon as fatigue indicators, it may be urged that the initial work-power of the subject is not taken into account, as it should in order that the figures be really indicative of proportional fatigue changes. For instance, the number — 84 is to be interpreted as indicating a smaller loss of work-power (less fatigue increase) during the second than during the first day. But if the initial fatigue was greater the second than the first day, a loss of 84 in the number of additions during the second day may very well mean greater loss of working power during the hour than was experienced the preceding day, although more work was done; we should then, if that supposition was true, expect the curve of the second day to show a greater rise than the one of the first, despite the fact that less work was accomplished.

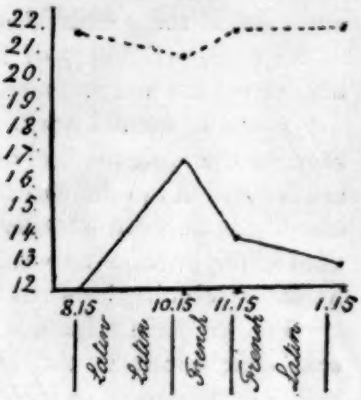
The measurements taken upon the Bryn Mawr students need not delay us long; they confirm the negative results of the others. Out of the thirty-six separate curves obtained, we pick out twelve (Fig. VI) possessing as fairly as possible the characteristics of the whole batch. The æsthesiometer was used at Bryn Mawr as Wagner used it—*i. e.*, instead of determining the one- and the two-threshold, the instrument was applied alternatively with the points too far apart to be felt as one and too near together to give the impression of twoness; from these two extreme distances the threshold was gradually approached. To keep the attention of the subject and prevent the influence which regularly in the succession of the sensations expressed as 'two,' 'one'; 'two,' 'one' might have, the subjects were frequently touched with one point only. The measurements were taken without haste and with due regard for the circumstances on which exactness of result depends: absence of disturbing external stimuli; ignorance on the part of the subject of the method pursued; interruption of about one minute and a half after every four or five touches, etc. Moreover, to prevent the bewildering effect which too many touch sensations produce when crowded in a short space of time, we endeavored to reach safe results with as few touches as possible. Eight applications of the instrument were found the lowest practical number for each threshold. Under these conditions about five minutes were required for the determination of the two thresholds—forehead and cheekbone—taken at each sitting. No attempt was made in this series to find out and avoid the temperature spots, our intention being primarily to imitate Dr. Wagner's method, and to use it on persons younger than the Heidelberg subjects. Nevertheless we proceeded, even in these experiments, with more care than the German investigators. The students who served as subjects were requested to keep faithfully at work from 8:15 A. M. to 1:15 P. M.; they understood that we wanted them to get as tired as possible, and they willingly entered into our purpose. During the morning they attended either three or four lectures or recitations; the rest of the time they filled with private work. The two post-graduate students who took the measurements here recorded knew that the discrimination sensibility is

Fig VI.

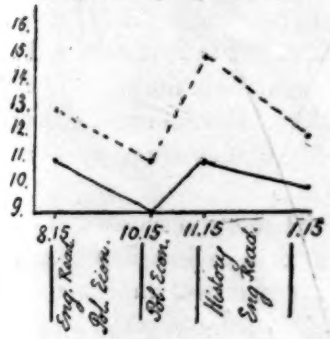
B. M. L. Age 19½
March 8.



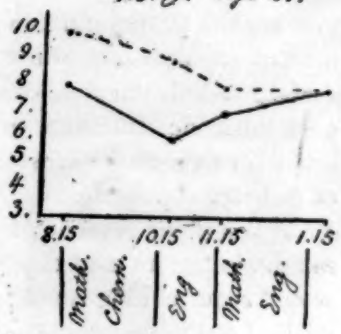
B. M. L. Age 19½
March 8.



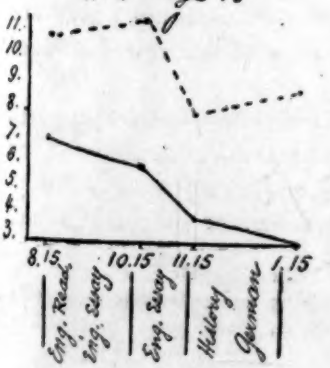
E. D. E., Age 20¼



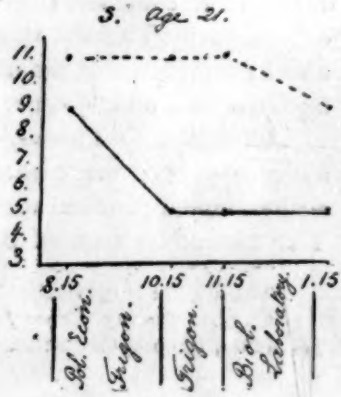
M. J. age 21.



H. H Age 18



S. age 21.



thought to decrease with fatigue, and expected their returns to agree with this belief; instead of this, they show an almost constant increase in the sensibility. The figures increase only 15 times out of 108 possibilities as we pass from one measurement to the next, and only 5 of the 36 curves end higher than they begin; yet the last measurement was taken at 1 : 15 P. M., after five hours of mental work, interrupted only by the time necessary for the tests, the first of which was taken 15 minutes after breakfast. As to the correspondence of the forehead with the cheekbone curve, the reader will see that on the whole it is closer than in the previous curves, but how far yet from the admirable harmony reigning between Griesbach's tracings![1]

The preceding facts warrant, it seems, the following general conclusion: If the ability to discriminate simultaneous tactile sensations is in some way under the influence of fatigue, it depends also and to such an extent upon other factors that it cannot serve as an index of the fatigue-state. These other factors are the temperature spots, the irregularities in the sensitiveness of adjacent bits of the skin surface, the temperature of the surface tested, the state of the blood circulation, the highly complex inner determinants of the intensity, duration, and kind of attention paid to the sensation, in so far as they are independent of fatigue, etc.

It is not our present purpose to enter into a discussion of the relative importance of these several factors; to do this profitably would require long series of skillfully planned and carefully carried out experiments. But we may, before closing, support our general conclusion by the results obtained and the opinion expressed by Tawney in a recent and painstaking work,[2] and also by a criticism of the method used and of the results obtained by Griesbach and Wagner.

According to Tawney—and this we have ourselves often noticed—it is of the greatest importance that the points of the æsthesiometer produce a sensation of equal subjective intensity. This cannot be secured by equal pressure of the points, since

[1] The full-line is the forehead curve; the broken line, the cheekbone curve.

[2] Guy A. Tawney, Ueber die Wahrnehmung zweier Punkte mittelst des Tastsinnes, Philosophische Studien, 1898, Vol. 13, p. 163.

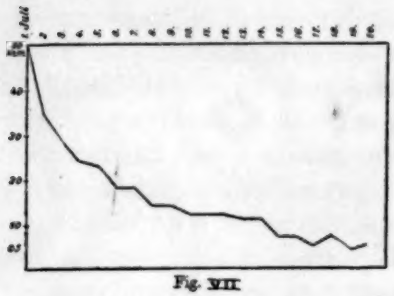


Fig. VII.

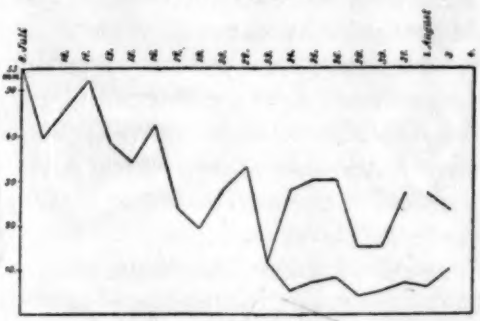


Fig. VIII.

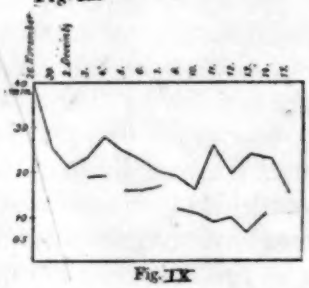


Fig. IX.

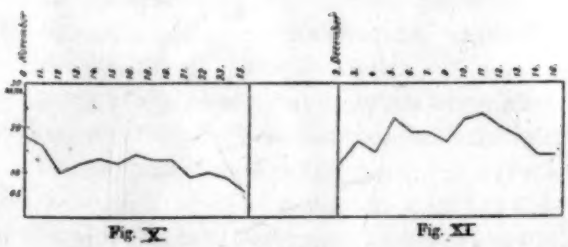


Fig. X. Fig. XI.

Figs. VII., VIII., IX., X. and XI. are taken from Guy A. Tawney's paper before mentioned.

neighboring bits of the skin differ considerably in the thickness of the insensitive superficial layer, and probably also in the sensitiveness of the deeper layer. He found, for instance, in one part of the shoulder blade that the point touching the skin lightly was felt more distinctly than the other, although heavily applied. Concerning the relative importance of fatigue and of the mood (Gemüthslage), he writes "Es Würde nämlich bemerkt dass die Gemüthslage der Versuchperson eine sehr bedeutende Rolle spielt, während z. b. der Umstand dass sie bis 12 Uhr in der vorigen Nacht gearbeitet hatte, fast gar keine Rolle spielte." He found also that widely different results were obtained when the attention was transferred from the object touching the skin to the subjective sensation, or when its intensity was altered by means of suggestions in the form of information imparted to the subject on the purpose of the experiments. But the point of greatest interest to us in Tawney's paper is the great variations shown by the threshold of the same person, measured at the same spot and at the same time on different days. Fig. VII and Fig. VIII, pp. 16–19, give the thresholds of two subjects measured at 7:30 A. M., on the same part of the body (the dorsal side of the forearm in the case of Fig. VII; the dorsal side of the upper arm in the case of Fig. VIII) on successive days.

The thresholds recorded for these curves are, for each day, averages of four threshold-determinations. This, according to Tawney, accounts for the regularity of the decrease of curve VII, a decrease due to practice; but it does not prevent Fig. VIII from showing daily oscillations reaching almost 20 mm. We are not told how the preceding nights were spent, but the remark quoted above indicates clearly enough that, in the opinion of the author, irregularities of the curve cannot be explained by fatigue due to late work and insufficient sleep. Fig. IX shows similar oscillations; but as the time of the measurements was not always the same, we cannot make use of them. The time at which the tests recorded in Figs. X and XI were taken is not mentioned; we may suppose that the rule was followed, namely, to measure always at the same time of day. The following figures, representing the thresholds for the volar side of

the forearm, measured daily during 19 days, indicate again very great variations: 60, 52, 60, 64, 54, 52, 55, 50, 42, 40, 45, 40, 45, 40, 38, 41, 42. The table numbered XV in Tawney's paper exhibits a similar irregularity; the thresholds for ten days separated by intervals of one to six days' duration are: 15, 25, 30, 40, 45, 45, 25, 16, 35, 45. The preceding curves and figures are not picked out of a larger number; they represent the whole of the results obtained by Tawney bearing upon our investigation. He had himself no intention of studying the relation of fatigue to the discrimination sensibility.

When these results and those obtained by ourselves are put together, it becomes difficult to look upon the work of Griesbach, Wagner and Vannod with any other feeling than one of wonder. When the resultant curves of three persons for three comparable days of hard, persistent work and for three days of rest—to speak only of the part of our work which we offer here—move up and down apparently without any reference to a fatigue clearly felt and legitimately inferred from the work performed; when an hour of adding by three persons, during six days, yields no better result; when five morning hours of intellectual activity on the part of six college students interrupted by only short pauses, bring with them remarkably uniform increase in the discrimination sensibility; when, moreover, it is known that the same spot may yield on successive days and under apparently the same conditions, results varying up to 20 mm., the admirable consistency and uniformity of the results published by the said investigators become a problem whose solution is not easily found. To this should be added that these remarkable results have been obtained under circumstances far from favorable to exactness of return. Wagner, for instance, measured in 10 minutes—the length of the interval between the class sittings—from six to ten persons at one point, and Griesbach, in apparently the same time, two or three subjects in six different places. This appears to us verging on the impossible.

If we now turn to the consideration of the method used by the German investigators, we find that Griesbach is not very explicit in his description of the manner in which he proceeded. His method was the one we followed at Heidelberg:

only, judging from the rather vague utterances of his monograph and from a private communication, he allowed himself a good deal of freedom. How far one could, with the help of a little looseness in the use of the æsthesiometer—a looseness unavoidable, it seems, when the measurements are to be taken as rapidly as they were in this case—unconsciously influence one's returns when possessed by an idea which, if confirmed by experiments, would prove of great scientific and of much practical value, is an open question. We may be excused for formulating it on this occasion.

Wagner's method was similar to the one used in Bryn Mawr by our students and ourselves: too great and too small distances alternating until the threshold is reached. This procedure is decidedly to be preferred to the former under the circumstances in point, the alternation of distances giving clearly two, with distances yielding but one sensation, gives to the subject, from the very beginning, a clear knowledge of the difference with which his judgment is to deal. Otherwise, if, for instance, the experimenter begins with a very small distance and increases it until the threshold is reached, the subject who has not had the opportunity of comparing twoness with oneness will often show by his answers that he does not know what he is to call 'one' and what 'two.' We tested many persons with regard to this, and found in almost every case that the usual verbal instructions are not sufficient: before the subject is made acquainted with the sensations he is to call 'two' and 'one,' he may call 'two,' two points clearly below the threshold and give the same answer when touched by one point; this source of error will be greatly increased if the subject gets into his head that it is to his credit to feel two points as often as possible. This objection applies with all its force to the method used by Griesbach, since his subjects changed generally each day and were expected from the very first trial to give recordable judgments.

Wagner declares his results to be in perfect agreement with those of Griesbach, and concludes that "the æsthesiometric method of Griesbach is a practical means of determining the degree of fatigue and of comparing it quantitatively" (p. 12). There is shown, he holds, 'a clear relation,' between the dis-

crimination sensibility and six specified circumstances, among which we find not only the sort of instruction received, but also the teaching ability of the instructor. For the interpretation of separate turns of his curves he shows a boldness of which Griesbach was not guilty. No doubt his results are in close agreement with those of Griesbach, yet there is one particular in which the concordance appears defective; in looking over his tracings it occurred to us that their upward gain was made chiefly, if not entirely, between the first and the second measurement, and that they frequently ended below the point reached at the second test—*i. e.*, after the first hour of study. In order to reach a definite opinion on this interesting point the sum was made (1) of the measurements taken before the beginning of the lessons; (2) of those taken after the first hour; (3) of those taken after the last morning hour, with the results given below. Each table in Wagner's paper includes the measurements taken on from five to ten students of the same class, before the beginning of the morning's work and after each recitation of one day. There were usually five recitations, separated from each other by an interval of ten minutes. Each one of the figures composing the first vertical row of our tables is the sum of the figures representing the measurements taken before work in one of the tables of Wagner; the figures of the second row give each the sum of the measurements after the first class hour, and those of the third row the sums of the last measurements of the same table. We have added before the figures the names of the studies after which the tests were taken. We omitted the measurements taken after 'Religion' when given during the last hour, because the lesson was attended by only about half the students used as subjects. We acted similarly with gymnastics that intellectual work only be taken into account. Furthermore, when the last figure was missing we left out, for that day, the measurements of the person concerned.

TABLE A.

MEASUREMENTS IN QUARTA.

55	French exercise,	79	Phædrus,	80	Thresholds of	6	subjects.
42	Arith. (Rechnen),	67	Latin,	91	"	" 8	"
86	French,	108	German,	120	"	" 8	"
78	German,	110	Geom.,	135	"	" 8	"
70	Geometry,	118	Latin,	106	"	" 6	"
45	Arithmetic,	73	Latin,	97	"	" 6	"
73	Arithmetic,	106	Latin,	136	"	" 7	"
83	French exercise, }	171	Latin,	173	"	" 9	"
104	German compos., }		German,	175	"	" 10	"
127	Latin exercise,	178	Latin,	180	"	" 10	"
114	Geometry,	188	History,	167	"	" 10	"
	Arithmetic,	160					
Totals: 877		1358		1460		88	

The average increase of the threshold between the initial and the final test is, accordingly, in millimeters,..... 6.6
Between the first and the second measurement,..... 5.5
Between the second and the final measurement,..... 1.2

TABLE B.

MEASUREMENTS IN UNTERTERTIA.

27	Latin,	35	Geogr.,	44	Thresholds of	4	subjects.
47	History,	51	Latin,	43	"	" 4	"
55	Greek Ex.,	77	Geom.,	65	"	" 6	"
93	German,	114	History,	99	"	" 8	"
57	Greek,	65	Geom.,	73	"	" 5	"
83	Greek Ex.,	114	Natural Sci.,	107	"	" 8	"
81	Latin Ex.,	107	Geogr.,	98	"	" 8	"
97	Greek,	107	Geom.,	106	"	" 8	"
87	Greek Ex.,	108	Natural Sci.,	118	"	" 8	"
90	Latin Ex.,	119	Geogr.,	114	"	" 8	"
Totals 717		897		867		67	

The average increase of the threshold between the initial and the final test is, accordingly, in millimeters,..... 2.2
Between the first and the second measurement,..... 2.7
Between the second and the last measurement,..... —0.4

Remarks on Table B.—Wagner explains as follows the surprising fall of the figures at the end of the morning in the second series (47, 51, 43): " * * * alles Erstaunen verschwindet und die Theorie erhält gerade hier eine interessante Bestätigung, sobald man erfährt, dass alle 4 Stunden dieses Tages von angehenden Accessisten gehalten wurden," p. 63. Unfortunately, the fourth series exhibits a similar drop (93, 114, 99) without 'Accessisten.'

Notice, also, that the 6th (83, 114, 107) and the 9th series (87, 108, 118) exhibit inverse changes of the sensibility, although the subjects of study were for both days the same: Ovid, Latin, Religion, Natural Science.

TABLE C.

MEASUREMENTS IN OBERTERTIA AND UNTERSECUNDA.

35	Caesar,	71	History,	68	Thresholds for 6 subjects.			
75	German compos.,	126	Latin Gram.,	117	"	"	8	"
32	Latin Grammar,	39	History,	49	"	"	4	"
37	Greek,	36	Latin,	54	"	"	5	"
72	Greek,	99	Latin,	96	"	"	7	"
44	Algebra,	58	Xenophon,	67	"	"	5	"
Totals: 295		429		451			35	

The average increase of the threshold between the initial and the final test is, accordingly, in millimeters,..... 4.5
Between the first and the second measurement,..... 3.8
Between the second and the last measurement,..... 0.6

What do these figures mean? Can they be reconciled with the claims made in favor of the æsthesiometric method? Are they to be interpreted as meaning that fatigue takes place almost entirely during the first hour, and remains nearly the same through four additional hours of work, one or two of which require as much exertion as the first? Before proceeding with this problem let us notice that, in this respect, Wagner's results agree neither with those of Griesbach nor with ours. During the first hour of work the sensibility of the three Heidelberg subjects increased (see Resultants, Fig. II). The same is true of the Bryn Mawr students, while the Griesbach curves continue to ascend more or less regularly after the first hour and generally end at the close of the morning (12 o'clock), higher than after the first hour—we refer chiefly to the cheek bone and forehead curves. It might be that this lack of agreement between the German investigators is due to the unequal difficulty of the subjects with which the morning's work opened in the respective classes to which their subjects belonged. As a matter of fact, in the classes with which Griesbach dealt, natural history and modern languages are frequently at the beginning of the schedule. But whether this be the ground of their disagree-

ment or not, the problem before us remains. It will not do to have recourse at this juncture to the different degree of attention required by the several branches of study, for, if we consider only the subjects of the last hour, leaving out of count the three middle ones, we see that they cannot be said to be clearly inferior to the first in respect of their fatigue-producing power; and even though they were of a somewhat less exhaustive kind, the curves would not thereby be explained unless it could be shown that between the first and the last hour the sensibility, in consequence of the recuperative quality of the three intermediary subjects, had nearly returned to the norm.[1] But to accept this would be equivalent, it seems to us, to giving up the claims of the believers in the method. It cannot be said either, by way of explanation, that the 10 minutes rest between each hour was enough to produce return to the normal; and that, consequently, the figures show the fatigue increase to have been, on the whole, about the same for each hour. It is evidently not true that two, three, four or five hours filled with the Gymnasium studies just mentioned leave the student just as fresh 10 minutes after.[2] We should rather be disposed to affirm that 10 minutes after the first hour of work a student might be quite fresh, while 10 minutes after the fifth hour he would be quite tired and often exhausted. Another explanation, plausible this time, but destructive of the claims under consideration presents itself to us: although nothing is said as to the place where the first tests were taken, we may assume that it was in the school building, the first measurement being taken as the students arrived from their homes. Now the usual condition of a young man after an early morning

[1] The intermediary subjects for the days on which the measurements were taken, were: History, Geometry and Phædrus; Phædrus, Grammar, and Geography; French, Gymnastic and History; Geometry and History; Drawing, Religion and Geography (this group is found only once); Drawing, Algebra, Ovid; Geometry, French, Greek and other similar groups. Considering Gymnastic, Wagner says (p. 126) summarizing: "The hour of Gymnastic has * * * in ⅓ of all the students (according to the most favorable construction of the figures) produced a relative recuperation; in the two other thirds it induced a clearly marked [ganz ausgesprochene] fatigue."

[2] Or shall we assume that it is only during the first hours that the Gymnasium student really works and that during the rest of the morning, either because of exhaustion or of laziness, he foregoes all tiresome mental effort? Probably no gymnasium director would countenance such a supposition.

walk and the exhilarating encounter with classmates is one of comparative bodily and mental alertness. An hour later, after a recitation in Latin, Greek or Geometry, the blood circulation, the respiration and the general feeling may be assumed to have changed considerably. Under such dissimilar circumstances we should hardly expect to get comparable æsthesiometric results. We have taken some measurements with the hope of determining the influence of these physiological changes, but we have been unable to have our subjects fulfill sufficiently well the conditions necessary for exact experimentations to warrant any positive conclusion. The temperature of the part of the body tested and of the room in which the measurements are taken should also be taken into consideration in an attempt to interpret the curve-peculiarity under discussion. Wagner experimented during February and the first part of March; consequently both the temperature of the skin of the face and that of the room would change materially during the first hour. Loewenton found that the threshold was elevated by an increase of temperature of the room. We need not insist on the possible influence of these two factors; the reader will see how they might have combined to bring about the relatively low figures of the first measurements. If accepted, this explanation would invalidate the conclusions drawn by the German investigators: the chief rise of the curves would not be due to fatigue, but to other causes. Unfortunately, we do not know whether Griesbach's different figures must be interpreted as discrediting this solution, for we are not informed as to the circumstances on which the comparableness of the figures of the two investigators depends. As to our own curves, all that can be said on this point is that they do not show a corresponding rise during the first hour; and that the cause we have suggested for this rise as it occurs in Wagner's curves existed neither in the case of subjects I., II. and III., nor in that of the Bryn Mawr students, since the latter and I. and II. were tested in their own rooms, while the measurements of III. were taken 15^{m} after his entrance into the rooms occupied by I. and II.

Returning to the general problem of the discrepancy existing between our results and those of the German investigators,

we may, in closing, advert to such thought as the following: the Heidelberg and the Bryn Mawr subjects might be, one and all, abnormal persons; or, we may have failed to get correct thresholds because of lack of skill in handling the instrument; or, our subjects were older than those of Griesbach and Wagner;[1] or, the discrimination sensibility of German youth is not comparable in its behavior to that of American men and women —thoughts which appear to us either inadmissible, or insufficient to silence the suspicion that the conclusions of the papers here considered are not well founded.

In this state of indecision we must let the matter rest for the present and until a thorough and systematic investigation of all the factors affecting the discrimination of simultaneous touches enables us to assign to fatigue its particular rôle. Two groups of factors will have to be taken into consideration: (1) those affecting the peripheral organs—temperature, thickness of epidermis, the peripheral blood supply, etc.; (2) those affecting the general psycho-physiological condition of the subject, and more especially his ability to attend. An *à priori* consideration of the influence possessed by these factors leaves but little ground for the hope that the discrimination sensibility to simultaneous touches may serve as a practical test of fatigue, for many of them (temperature, blood circulation) vary under unchanged fatigue conditions. As to attention—considered independently of its relation to fatigue—it lacks the constancy and steadiness which are absolutely required if the experimenter is to draw his inferences from a very small number of measurements. It is a rhythmic function, and, moreover, is readily and rapidly modified by the will to attend—a quantity that cannot be maintained constant.

[1] No age limit is set by them to the applicability of the pretended relation existing between the discrimination sensibility and fatigue. When testing persons of the age of our Bryn Mawr subjects, Griesbach found the same results as when dealing with younger persons.

ON THE INVALIDITY OF THE ÆSTHESIOMETRIC METHOD AS A MEASURE OF MENTAL FATIGUE.

BY DR. GEO. B. GERMANN,

Columbia University.

While engaged in reading the literature on fatigue some two years ago, I became interested in Dr. Griesbach's investigation on the relation between mental fatigue and the discriminative sensibility of the skin.[1] Dr. Griesbach, it will be recalled, claimed to have ascertained a close and definite correspondence to exist between the extent of sensation areas and the fatigue incident to school and other mental work, the main hypothesis being that fatigue increases the size of such areas, while rest diminishes their extent on any defined portion of the skin. His interesting results apparently confirmed this hypothesis, but I doubted the validity of his method and therefore his results. That method consisted in rapidly increasing minimal distances and decreasing maximal distances between the æsthesiometer points until the extent of the sensation area was determined. Furthermore, apparently only one determination was ascertained in each case. Griesbach fails in his paper to indicate how he satisfied himself that he had obtained this end within any reasonable degree of accuracy. It is a matter of common experience that as the sensation-area limit is approached, tactile illusions become numerous, and any single determination near the limit may be more of a guess, or perhaps a purely illusory statement, than a safe judgment. The employment of the method of right and wrong cases is undoubtedly the safest method whereby to determine the accuracy of a series of judgments relative to tactile discriminations.

Wishing to get at the facts of the case, I undertook the following investigation during the period from February 24 to

[1] *Archiv für Hygiene*, 1895, Vol. XXIV., 124–212.

March 25, 1898. As subject I made use of my sister *S*, age twenty-three, a student at Barnard College, an earnest and diligent worker, health good, nervous condition normal.

The method employed was that of right and wrong cases. Jastrow's æsthesiometer was used during the entire investigation. This æsthesiometer is so constructed that when the points are placed upon a horizontal surface the pressure upon that surface is equal to the weight of a constant portion of the instrument. In order to obviate the inequality of pressure incident to tipping the æsthesiometer sidewise in securing a one point contact, the instrument was slightly modified so as to secure the desirable equality of pressure without the usual inclination.

All of the usual and necessary conditions attaching to æsthesiometric experiments, such as equality in the temperature of the room, absence of undue surface tension of the skin, blindfolding the subject, securing focalized attention, etc., were carefully observed and rigidly adhered to. All determinations were made upon a circumscribed area of the skin of the back of the right hand between the second and third metacarpals and about two-thirds distant from the corresponding carpals. A previous series of morning determinations, checked by means of the method of right and wrong cases, had indicated the length of the sensation area of the circumscribed region tested to be, on the average, a slight fraction of a millimeter over two centimeters. This (2 + cm.) was the constant distance between the æsthesiometer points employed during the investigation.

Fifty contacts were made during each of the first thirty-five tests, while during each of the other seven tests I had an opportunity to make one hundred contacts, thus affording a total of 2450 separate discriminations to be made by *S* during the progress of the investigation. Each contact lasted about one-half a second. An interval of ten seconds was allowed to elapse between successive contacts. On 27 out of the 30 days covered by the investigation a total of 42 tests was made. Of these 42 tests, 20 occurred in the morning between 8 and 10 o'clock, previous to any definite study, while the remaining 22 tests were made in the evening, slightly distributed, but for the most part

between 9 and 10 : 15 o'clock. At least eight hours of the interim between the morning and the evening experiments were always fully occupied by *S* with her collegiate studies, of which two hours' work usually preceded the evening test.

In collating my data I have, in order to reduce the results of the experiments to a very simple form, determined (*a*) the total percentage of errors in discrimination occurring during each test, (*b*) the percentage of errors occurring during each test in the discrimination of two points only, and (*c*) the percentage of errors occurring during each test in the discrimination of one point only. The references to (*a*), (*b*) and (*c*) are in the following statements designated by total, two and one, respectively. The results of the investigation may be most readily collated as follows :

	(1) Morning.		(2) Evening.	
	Average.	Variation.	Average.	Variation.
Total.	15.1 %	6.8 %	12.6	9.1 %
Two.	17.3 %	10.1 %	20 + %	16.4 %
One.	12.8 %	9.5 %	5 +	5 %

Explanation.—Glancing at statement (1) we perceive that during the morning tests the total percentage of errors arising in the discrimination of both two points and one point amounts to 15.1%, with a variation of 6.8% ; that the percentage of errors arising in the discrimination of two points alone amounts to 17.3%, with a variation of 10.1% ; and that the percentage of errors arising in the discrimination of one point alone amounts to 12.0%, with a variation of 9.5%. The interpretation of statement (2), which refers to the evening tests, is to be made in the same way.

Of the total number of tests, 14 pairs were conducted on the morning and evening of the same days. It is both interesting and significant to consider these pairs apart from the entire series, and I believe that the following statements will serve to throw the results into bold relief.

	(3) A. M. = P. M.	(4) A. M. > P. M.	(5) A. M. < P. M.
Total.	4	8	2
Two.	1	9	4
One.	2	9	3

Explanation.—Statement (3) indicates the number of times that the morning (A. M.) and evening (P. M.) tests of the same day contained the same total percentage of errors in the discrimination of both two points and one point (total), of two points only (two), and of one point only (one). Statement (4) indicates similar results with respect to the number of times that the percentage of errors was greater in the morning than in the evening; while statement (5) refers to the number of times that such percentage of errors was less in the morning than in the evening.

A comparison of statements (1) and (2) brings to light several important facts. The percentage of all errors occurring during the morning series is $15.1\% \pm 6.8\%$, while the percentage of all errors occurring during the evening experiments is $12.6\% \pm 9.1\%$. That is, less errors occurred in the evening than in the morning, if the variation be discarded. Including the variation, we have practically equal results at the upper limit, while at the lower limit the errors are less and in favor of the evening tests. It is also readily seen that the percentage of errors in the discrimination of two points is slightly less in the morning than in the evening (this taken by itself would favor Dr. Griesbach's hypothesis); and that the percentage of errors in the discrimination of one point is more than twice as great in the morning than in the evening.

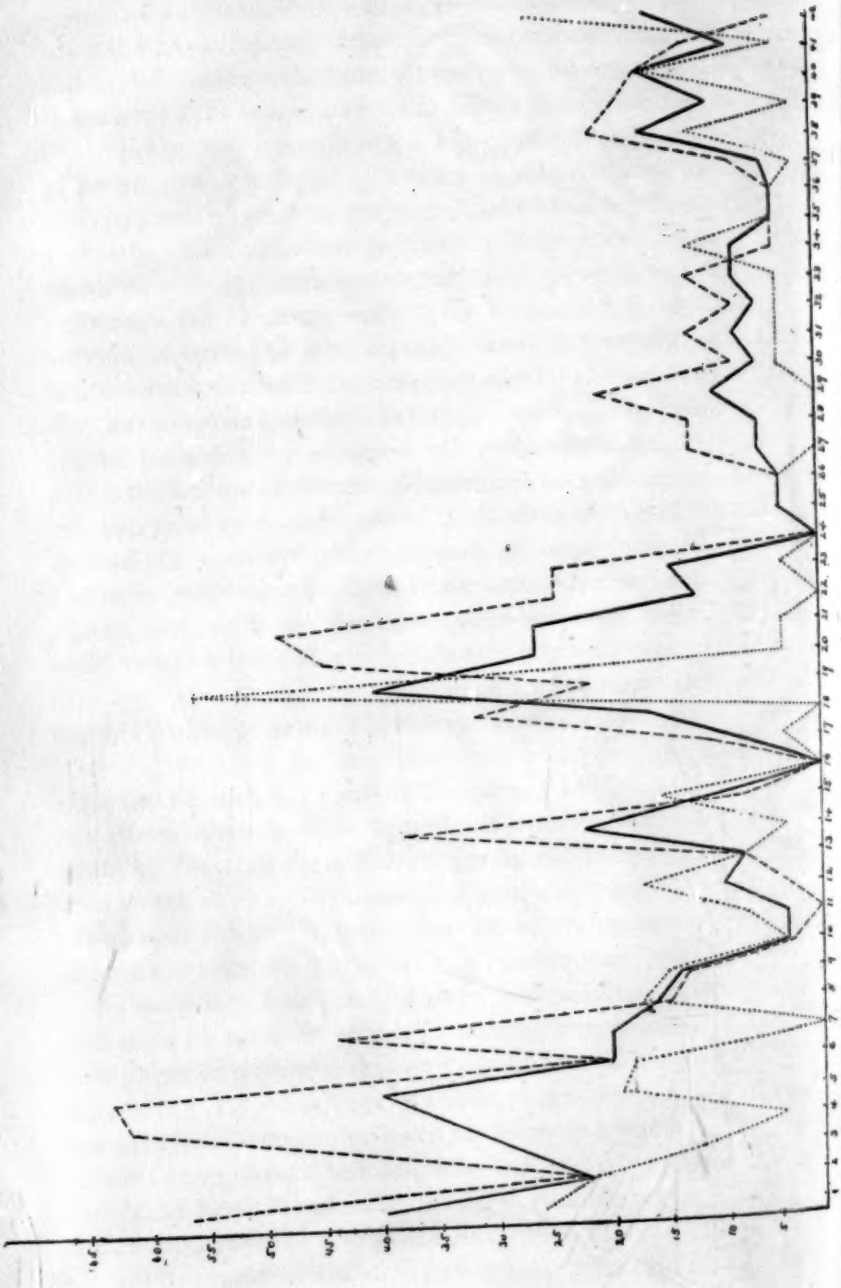
If we now examine statements (3), (4) and (5), the general trend of my results will become much more clearly defined. We see at a glance that out of the 14 days there considered, on 8 days the total number of errors was greater in the morning than in the evening, on 4 days the total number of errors of both morning and evening was equal, and on only 2 days did the total number of errors in the evening exceed the number occurring in the morning. Furthermore, on 9 days was the number of errors occurring in the discrimination of two points greater in the morning than in the evening, on 4 days less in the morning than in the evening, and on 1 day equal. The interpretation of the results of the one-point discrimination can be readily made in a similar manner.

Now according to Dr. Griesbach's hypothesis, mental fatigue

diminishes cutaneous sensibility, and this diminution in sensibility is normally accompanied by and correlated with an increase in the extent of any single sensation area. Were this normally and universally true, then in a series of experiments where the distance between the æsthesiometer points remained constant we should be led to expect an appreciable increase in the number of errors in discrimination, at least in the discrimination of two points, toward evening and after a day of severe mental work. But my results plainly indicate that in a sufficiently prolonged study of these phenomena in the case of a normal, healthy and active student no such appreciable increase in errors occurs. In fact, an examination of the above statements (1) to (5) *in toto* may have the tendency to force the conviction that just a diametrically opposite condition of affairs prevails; so that were I inclined to be rash I might be tempted to advance the hypothesis that, in the case of at least one student, mental work and its concomitant nervous strain have a tendency to refine cutaneous discriminative sensibility, probably owing, I should then be tempted to add, to a general hyperæsthesia induced by a general diffusion of neural energy. But I do not advance any such hypothesis.

The results of this investigation are summarized in the acpanying curve.

Explanation of the Curve.—The line of abscissæ represents the successive tests, while the line of ordinates represents the percentage of errors occurring during each test. The three main lines of inquiry are here indicated. The dash curve indicates the percentage of errors occurring during the tests in the discrimination of two points; the dotted curve indicates similar errors in the discrimination of one point, and the continuous heavy line indicates the total percentage of error in each test. The following numbered tests represent morning experiments: 2, 5, 6, 8, 10, 12, 13, 15, 17, 19, 21, 23, 25, 29, 31, 33, 37, 38, 40, 42. The others represent the evening experiments. The following tests occurred in pairs—*i. e.*, on the morning and evening of the same days: 6 and 7, 8 and 9, 10 and 11, 13 and 14, 15 and 16, 17 and 18, 19 and 20, 21 and 22, 23 and 24, 25and 26, 29 and 30, 31 and 32, 33 and 34, 40 and 41. It will be observed that the



above continuous heavy curve contains several of the characteristic properties of a practice or habit curve. This is what we should be led to expect from the work of others, who have ascertained that a refinement in tactile discrimination ensues as the result of the continued exercise of this sense. It may, furthermore, be of interest to note that during the progress of the experiments *S* several times remarked of her own accord that she believed she could feel the two points better than at the beginning of the series. Beginning with the twenty-fourth test, the variations are not so great as previously, nor are the percentages of errors very large. Yet the record of the subjective condition of *S* indicates a state neither more nor less favorable or unfavorable toward the end than at the beginning. In order to anticipate any objections that might be raised on the ground of the experimenter's clumsiness at the beginning of the series, I wish merely to remark that I thoroughly tested my method and gained facility before applying it. Of course, added practice begets added facility.

From the above results, I believe, we may reasonably conclude that the æsthesiometric method in a special normal case, at least, does not furnish a constant nor even relative index as to the amount of mental fatigue experienced by the individual. I have found in several investigations on sensation areas, by Judd and Tawney, an enumeration of normal fluctuations that correspond quite closely with the amplitude of variation which Griesbach, and more recently Wagner, ascribe to the influence of fatigue. Furthermore, the subjective state of *S* was carefully ascertained during the progress of the investigation. A general comparison of that subjective condition with the percentage of errors during each test gives further evidence in support of my conclusion that *in at least one normal case the percentage of errors in cutaneous tactile discrimination bears no constant nor even relative correspondence to the mental fatigue experienced by the subject.*

I am convinced that, in special cases, the æsthesiometric method is absolutely inadequate for the determination of mental fatigue. Moreover, I strongly doubt its validity in any case.

A PLEA FOR SOUL-SUBSTANCE. II.

BY W. P. MONTAGUE,

Instructor in Logic, University of California.

'*De Natura Animæ.*'

This inquiry into the nature of the soul, or, more exactly, into the nature of soul-substance, is the sequel to a former paper on the existence of soul-substance. The contents of that paper were as follows:

1. An introductory statement of the causes for the unpopularity of conceptions of substance in modern philosophy and particularly in modern psychology.

2. A description of the central problem of explaining the apparent interaction of the world of Mind or teleological law, and the world of Matter or mechanical law.

3. An outline of the five hypotheses actually used in the solution of this problem of the seeming causality between incommensurates, to wit:

a. Absolute Teleology—the denial of efficient causes.

b. Materialism—the denial of final causes.

c. Occasionalism—the co-reality of mechanism and teleology admitted—their mutual interaction being explicable only by miracles.

d. Parallelism—the admission of both realms as real, but their apparent interaction explained as an illusion due to a complete parallelism.

e. Spiritualism—the theory of a soul-substance different from mind and matter, yet partaking of the nature of both—therein explaining the possibility of real causality between the two spheres.

4. An exposition and attempted refutation of the first four theories—especially of Parallelism.[1]

[1] In this refutation of Parallelism I made use of the fact that concomitant variation excluded Parallelism. There seem to me to be a certain obscurity and

5. An indirect proof of the existence of soul-substance based on the failure of all other possible solutions of the problem. Direct proof based upon the axiom of "No action at a distance."

6. Conclusion—exposition and proof of the three requirements to be fulfilled by a valid conception of Substance in order to distinguish it from (*a*) the 'Ding an Sich,' (*b*) the 'additional attribute,' (*c*) the 'totality of attributes.'

It is the explicit purpose of the present paper to show the nature of the soul-substance the existence of which is to be regarded as proved in the first paper. To accomplish this task it is necessary to show that experience affords us an example of a mode of sequence which, while it is neither merely mechanical nor merely teleological, is nevertheless (1) simple and intelligible in itself; (2) related to efficient and final causality as genus to species, and (3) as species to genus.

Such a mode of experience would be the direct expression or definition of the nature of soul-substance. Its substantiality

imperfection in the argument as there given, and I therefore take this opportunity of supplementing it by the following statement:

Notwithstanding the fact that Mill (*Logic Bk. III. Ch. 8*) regarded the Method of Difference as superior to the Method of Concomitant Variations, yet it seems to me that the latter method is by far the more cogent, supplementing, as it does, the Method of Difference very much as that method supplements the Method of Agreement. The Method of Agreement gives a probability that *A* is at least part of the cause of *B*. The Method of Difference gives a certainty that *A* is at least part of the cause of *B*. The Method of Concomitant Variation gives a certainty that *A* is part of the cause of *B*, and *also* a probability that *A* is the whole cause of *B*, which probability approaches certainty as the concomitance approaches perfection. The ground of our belief that *A* is not merely a part or 'collocation' of the cause of *B*, but the whole cause itself, is the fact that for every part of *B* there is a corresponding part in *A*, and that there is nothing in *A* without its correlatein *B*. The concomitant variation of the ratiocinative and physiological sequences, which is admitted by the parallelist to be perfect or complete, carries us beyond parallelism; for if it is complete, it implies a correspondence of every infinitesimal part of the one process to every infinitesimal part of the other. Such a type of relation is perfect as to its homogeneity and is all that we can mean by causality. Just as two parallel lines when prolonged to infinity cease to be parallel, and just as two similar objects if their similarity were infinite would cease to be similar and become identical—*just so a psycho-physical parallelism when it is made as perfect as it claims to be—and must be—ceases to be parallelism and becomes causality.* In short, the parallelistic theory when closely examined is seen to be necessarily and peculiarly self-transcendent.

with respect to the mental and material attributes would be provisionally manifested in its appearance as the common Limit approached on the one hand by a series of teleological sequences, becoming more and more perfect, *i. e.*, more free from the taint of contingency—and on the other hand, by a series of mechanical sequences approaching mechanical perfection or absolute independence of all teleological references.

The resemblance between the concept of Limit and the concept of substance is sufficiently striking to demand careful consideration. What is a mathematical limit? It is the goal or end approached by a series, *e. g.*, the sum of $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots$ approaches 2 as its limit. Now 2 is a perfectly definite thing with a perfectly real and definable nature; at the same time it differs absolutely from the sum of n terms of the series, when n is any number we please. If we represent the sum of the first r terms of this series by Σ_r, we may express our series thus: $\Sigma_1\ \Sigma_2\ \Sigma_3\ \Sigma_r \cdots 2$, where 2 is the limit or last term of the series. It is to be noted that the members of this series (so far as they are viewed serially, *i. e.*, as interrelated) have one common quality which makes us classify them as members of one series. The influence of the limit of a series is present throughout the series determining the relations of the members to one another precisely as the Universal of a class is present in each of the particular members.

The limit differs, however, from the mere Universal in two highly important points:

1. While it is admitted by all except Platonists that the Universal can never exist apart from or independently of its particulars, yet it is perfectly evident that the Limit can and invariably does exist as prior to and aside from the members of the series which approach it.

2. The Universal can never be made a member of its own genus (although Aristotle accused Plato of doing that very thing); while, on the other hand, the Limit is always a member of the series which it determines, *e. g.*, 2 is the last member of the series given above, and it is also a member differing from all previous members in that it alone is an integral number. Thus it appears that the Limit has not only the generic char-

acter common to all universals, but that it also has the individual character of existing and of being known independently of anything outside. And last and most remarkable, it has the characteristic of being a member, and a wholly unique member, of its own class (series).

When we affirmed that the substance concept must possess the three qualities of being:

1. Self-intelligible.

2. Related to its attributes as genus to species.

3. Related to its attributes as species to genera. We might well have felt that modern philosophy was fully justified in repudiating such a thoroughly inconsistent and paradoxical notion as that of Substance. And yet in the familiar and useful conception of a Mathematical Limit we are able to see with the greatest clearness and certainty all of these three essential properties of Substantiality. By virtue of its knowability and definiteness, the concept of substance, like its mathematical brother the Limit, differs from Pure Being or from the Ding an Sich; by virtue of its generic character it differs from all particular qualities or atoms, and by virtue of its specific character it differs from universals or ideas.

In view of these considerations we shall be guided in our search for the nature of soul-substance by the well-known method of Limits. We have for our problem given the nature of the attributes (viz., mind and matter), and the fact of their interaction—to discover the nature of the Medium (viz., soul-substance), in virtue of which the relation of these attributes is possible.

Our undertaking will be divided in two general parts.

1. The search for the limiting forms or perfect types of mechanical or material relation. 2. The search for the limiting forms of teleological or mental relation.

First, then, we have to seek for the limiting or perfect form of mechanical causality or of the relation between facts as such. Take the following case: I hear the word 'Jacques,' and immediately there presents itself to my mind a picture of a melancholy fellow in a green doublet; following upon this picture there comes another picture of another melancholy man in a

red cloak. I am a school boy commanded to write a composition on 'As you Like It,' and I write the sentence, "Jacques resembles Hamlet." This is a typical psychical sequences, and without attempting the impossible task of a complete analysis of what occurs, it will at least be useful for our purpose to note some of the more obvious factors at work in the process. In the first place, Hamlet and Jacques both possess the quality of 'melancholy,' hence I have a rational ground for asserting their resemblance. Hamlet is associated with Jacques as co-member of the same species. This then is the teleological ground of my judgment regarded as a psychological sequence, and when so regarded it is usually called Association by Similarity. In the second place, I write down the sentence, "Jacques resembles Hamlet." I write this because I want to finish my exercise in composition as soon as possible in order to be free to go skating. I do it to fulfill a want or need of my immediate organism. This desire for satisfaction, or aversion to dissatisfaction, may be called the organic or biological cause of the action. In the third place, the image of Jacques in a *green* doublet calls up the image of Hamlet in a *red* cloak—why this change of color? Upon reflection I cannot remember ever having seen Hamlet dressed in red, and yet it is this color and no other that is presented with vividness to my mind's eye. We know, however, that green and red are complementary colors, and that one is apt to call up the other owing to what is probably a chemical change in the substance of the retina. Let us then call this the chemical cause of the process. And now there is one more type of causality at work in the production of this judgment. It so happened that I read 'Hamlet' and 'As You Like It' together. As a consequence of this fact, the sense impressions of the one play are very closely bound up with those of the other. The two sets of personages are associated by Contiguity. No one doubts the validity of this psychical law of Association by Contiguity. Some psychologists, in their praiseworthy ambition to banish final causes from their science, even go so far as to reduce Association by Similarity to a mere complex kind of Association by Contiguity. Inasmuch as Contiguity is a mechanical and temporal affair, while Similarity

is teleological and non-temporal, we may assume, on the strength of the criticism of Psychophysical Parallelism given in the former paper, that this attempt at simplification is doomed to failure. It may perhaps be asked on what grounds we select the law of Association by Contiguity as the distinctively mechanical type of mental causality. By way of answer let us consider what probably happens when two ideas are associated by Contiguity. A sense impression a is suggested to the mind at a given time t_1. Another sense impression β is suggested to the mind at a later period of time t_2. Physiological psychology warrants the supposition that at the moments when a and β are perceived there are two physical modifications a and b induced on the matter of the brain, and the same science also warrants us in supposing that, corresponding to the mental process of a arousing β, there is a physical process consisting in the communication by spatial transition of something in a to something in b. Experimental psychology proceeds further, and assures us that, other things equal, the rapidity and the certainty or constancy of the association between a and β varies inversely as the length of the time interval separating t_1 and t_2. Granting these facts, we have the case of a mental sequence conforming exactly to the laws which govern a purely physical change, *i. e.*, a change from one position in space to another. The rapidity and certainty of this change moreover are measured by the 'distance' between the two positions. From this it follows that we are justified in the assertion that in Association by Contiguity we have a case of psychical sequence conforming to the quantitative laws of mechanics.

So much for the four kinds of causes which we may call the Teleological, the Biological, the Chemical and the Mechanical. Let us now leave the domain of mental life in which these four kinds of cause are usually found operating together, in order that we may study in comparative isolation, and so far as may be in serial order these several types of relation. At one end of the series we have purely 'final causality,' at the other end we have 'efficient causality.' Between the two we have the biological causality, which is predominantly teleological, and the chemical causality, which is predominantly mechanical. When

we leave the neutral or mixed ground of psychology for the field of biology, what difference do we notice in the laws of the two sciences, as to their respective types of relations between facts?

In biology, all changes or sequences are explained on the basis of the desires or needs of the organism. Two phenomena α and β are seen to follow one another in time. If the sequence fulfills the three conditions requisite for the valid inference of causality, viz., mutual presence and absence and concomitant variation—then the biologist is justified in assuming that α and β are connected with some specific need of the organism and therein connected with one another. This medium of relation has two aspects—a *qualitative* aspect which depends upon the kind of organism in question and the particular circumstances in which it is placed, and a *quantitative* aspect which is simply the strength of the desire. Given the knowledge of these two conditions the actions or sequences of an animal may be predicted. In the higher organisms the qualitative aspect is much more pronounced than in the lower organisms. In the case given above in which I associated Hamlet with Jacques, the quantitative aspect of the sequence, regarded biologically, would be the degree to which my judgment of resemblance contributed to the preservation of my organism. Obviously this was very small indeed. If I had made any other assertion or had failed to make any, the vitality of my organism would have suffered to an extent almost inappreciable. Supposing, however, that, instead of desiring to write a composition on a play of Shakespeare's, I had desired to satisfy a particular craving for a certain kind of food—in this case the quantitative aspect of the causal relation would play a much greater part. In a healthy organism all cravings are normal, and the satisfaction of any one is a direct contribution to the vitality of the animal. In so far as these cravings are numerous and varied the same needs of the organism can be satisfied by different objects. An animal desires one kind of food, but if this is unattainable, his desire can be almost as well satisfied by another. In short, just what the particular acts of an animal will be depends upon qualitative conditions much more than on conditions of quantity. Nevertheless as we descend in the scale of organic complexity the qualitative factor

in the actions decreases in importance, until in the lowest types of animals or the highest types of vegetables we find a few well-defined desires, usually arranged in a pretty definite hierarchy, and it becomes more and more difficult to satisfy one desire with the objects of another, or to leave a desire unsatisfied without destroying the whole organism. We express this decrease of qualitative and increase of quantitative causality by saying that the lower the organism the less selective are its acts, the more is it dependent upon or determined by its environment, and the more certainly predictable are its changes. Its nature is less *intrinsic* and more *extrinsic*. Finally when in the descending scale we leave the lowest type of vegetable and enter upon the study of the actions of the crystal, we find the qualities of this semi-organism arranged not merely in a general hierarchy, in which each desire is indefinitely stronger or more important than its neighbor next below, but rather do we find a state of things in which each quality bears a definite and mathematically determinable relation to every other quality. The changes in the crystal become subject to the *à priori* laws of quantity when once we have learned empirically the specific or qualitative nature of the crystal. We may put the matter thus—why and how the crystal should be what it is is not explicable, *i. e.*, not dependent upon any objects external to it, but being what it is, all its changes may be explained or predicted.

Let us now pass from the sphere of Biological Causality to that of Chemical Causality. At first sight the new class of phenomena does not appear to differ very much from the phenomena of crystallization. We have a substance known to possess certain properties or qualities, known also to be decomposable into a definite number of certain other and simpler substances called elements, and finally known to possess definite and unchangeable relations both qualitative and quantitative to all other substances. We notice, however, that we can decompose a chemical substance into its elements and then put these elements together and get back the original substance. Now with no type of organism or of crystal is this reverse process possible. And this is the most noteworthy difference between the substances of biology and the substances of chemistry. The chem-

ical substance has apparently no intrinsic life of its own, not even a crystalline power of initiative. It has, to be sure, a very rich qualitative nature, but we can force it to run through the whole gamut of its changes simply by altering its relations to other substances. An organism, however, refuses to be put through its tricks against its will. Break a crystal or an organism and you cannot mend it. Break the chemical compound and usually nothing is easier than to mend it. Hence in Chemical Causality we first come to what appears to be a *reversible series*—the possibility of a change which is not also a growth. A chemical substance can be changed in two directions—can grow old and can grow young, *i. e.*, not grow at all, but only alter. We have, to be sure, the interesting fact that all chemical processes have strong preferences of direction in these reversible changes. It is very easy to produce water by combining hydrogen and oxygen, while it is somewhat more difficult to decompose the water into its elements. And this fact is interesting, I say, as showing that the break between the organic and the inorganic world may not be an absolute matter, but only one of degree. A chemical substance which persisted in altering in one direction only in spite of all external agencies could very properly be classed as an organism.

As we turn from the more complex substances to the less complex, we naturally find the qualities of the substance growing more and more simple and the quantitative factor coming more and more into prominence. Until the discovery of Mendeleef's Law it seemed that the process of simplification had come to a final stop with the classification of all chemical substances into various quantitative compounds of the original elements. Mendeleef's Law, however, shows that these elements are not only related to one another quantitatively, but that the several qualities which distinguish the elements from one another form a somewhat irregular, though undeniable series, analogous in type to the series of spectrum colors. The nature of this series is such as to enable us to predict the qualitative nature of an undiscovered element simply from a knowledge of its quantitative relation to Hydrogen. Thus in this last discovery we see the element of quantity all but supreme, and it is

an easy step from these quantitatively related elements of Physical Chemistry to the quantitatively related states of matter which form the subject-matter of physics proper. Ice changes to water and water to gas, and these three qualities are all produced in turn by simply changing the motion of the molecules. Motion, however, is but a function of Space and Time, and to reduce all change to a change of molecular motion is equivalent to reducing all causality to the change of spatial position by a material body. The laws that govern molecular motion are not yet known, hence physics is still to some extent dependent upon the empirical observation of qualities. But now the qualitative element is merely the *ratio cognoscendi* of the causal laws and not as in biology, the *ratio essendi*. In mechanics and kinematics we at last arrive within sight of pure quantitative causality untainted with any spark of teleology, *i. e.*, of quality, unless indeed the quanta of mass and distance be themselves called qualitative.

Mechanical change is change of position. Mechanical causality is the law which governs this change of position, and it is a simple function of the initial velocity, the mass and the distance. The velocity or measure of motion is, as we have seen, simply the limiting ratio of a particular filled space to a particular filled time, while the mass of a body, as Karl Pearson so well shows, can be expressed or measured in terms of the acceleration produced upon other bodies. The velocity of the falling apple has a definite acceleration, which is the effect and measure of the mass of the earth. Since mechanical change can be adequately expressed wholly in terms of space and time, and since time relations permit of spatial representation, we have it in our power to symbolize adequately every mechanical change by a geometrical graph, called by its discoverer a 'Hodograph.' When a body moves according to mechanical law we can regard any antecedent state of that movement as the cause of every consequent state or effect. In short, it is only in the case of the freely moving particles that we can accept with a clear conscience the Humean identification of causality with universal sequence. If we feel it necessary to ask for the third substance, or thing in virtue of which the two terms of ante-

cedence and consequence are causally united, we simply point to the empty time and space intervals separating the two terms. The very fact that the pure movement between two 'space-time' or 'Hodographic' points is not only a continuous change in the popular sense of the word continuous, but a homogeneous or truly continuous change, is enough to satisfy the demand of reason for the third thing or medium as ground of relation between two terms. Two commensurate quantities are just as truly related through the fact of continuity as are two qualities through the fact of participating in a third or generic quality.

Now not only has Professor Pearson (after Clifford) reduced Mechanics to a species of geometry, but geometry itself is reducible to a species of algebra, called analytic geometry. In virtue of this latter science we are, with respect to a fixed point chosen arbitrarily and called an origin, able to express all position in space as a complex algebraic quantity, the degree of complexity depending upon the number of axes necessary to distinguish every point from every other.

If all positions were confined to a straight line, we could determine each of them by a single algebraic quantity (x). If, again, all our points were in a plane we should require a dual quantity for the definition of a point (x, y). In our actual three-dimensional space we require three axes from which to measure, and consequently a point can only be algebraically defined by a three-fold quantity (x, y, z). When we introduce in addition to the merely spatial relations the *kinematical* factor of the temporal velocity with which the particles are altering their positions, we are obliged to bring a fourth element (v) into our quantity in order to define it as distinct from its 'spatio-temporal' or hodographic neighbors; and finally when we take into consideration the *mechanical* factor of Mass or accelerated velocity (w), we may be said to be dealing with changes in a five-dimensional world, and consequently to require a quantity of five-fold complexity in order to express the whole state of a body with a given mass and velocity, at a given point in space and time, in such a way that its future states, *i. e.*, its future relations to another similarly determined body (viz., the center

of mass of the system in which it is), may be predicted with certainty. Thus any body which being a member of a mechanical system is at any moment of time t_1 represented by the five coordinate quantities $(\{x_1, y_1, z_1\}, v_1, w_1)$, signifying respectively its position in three-dimensional space, its velocity or position in time, and its acceleration or mass, all relative to a fixed point O which is both origin and center of mass—will at any subsequent moment t_2 have changed to a state which can be represented by $(\{x_2, y_2, z_2\}\, v_2, w_2)$, where $(\{x_2, y_2, z_2\} v_2, w_2)$ is a determinable function of $(\{x_1, y_1, z_1\} v_1, w_1)$, and as before said, we can regard the body in the first state as the *cause* of the body in the second state. For brevity let us call these two complex quantities A_1 and A_2. Now we know for various reasons (among others the fact of the loss of energy necessary in every system) that no change is wholly cyclic, *i. e.*, the state of a material system never repeats itself in time. With respect to O, A_1 and A_2 or An and $An + m$ must differ, and what is more important, they must differ positively or in one direction only—for if they did not the history of a system would repeat itself and we should have a cyclic change, which is impossible. $An + m$ can never be equal to An, and consequently An, $An + 1$, $An + 2$ ... $An + m$ must be quantities which stand in an irreversible series —a series such that any member Ar must be 'further' from $Ar - 2$ than from $Ar - 1$. This character is, however, precisely the character of our own numerical series, and we may, therefore, say that the series in question is not only an irreversible but an increasing series. But it must be remembered that all this is only true with respect to our own chosen origin O. We can always select another point in space O' as origin and center of mass, with respect to which the series A_1, A_2, A_3, could be read in the reverse direction, where, for example, A_2 with respect to O could be shown to be less than A_1 with respect to O'. Hence it is only on the supposition that O is a fixed point that we can show that mechanical change is irreversible or absolute, and not reversible or relative. What does this possibility of selecting another origin mean? It means simply that no given system is absolute, but only relative, and that consequently the changes in a system can only be predicted in so far as that system

is taken as absolute, *i.e.*, as either isolated from or inclusive of the rest of the universe. This is precisely the assumption upon which Science proceeds. In a small system of bodies the error due to the interference of other systems is great. As the system is enlarged the changes become more regular, and the error decreases, owing to the diminishing interference of other systems until it finally can be neglected. Could we grasp the universe as a whole, we should then have a system in which every element necessarily changed in one direction, and could consequently be expressed as an increasing quantity or series of quantities with respect to an absolute center of Mass or Origin.

We have now reviewed the various types of causality in the order of descent. Starting from the mixed stage of psychical causation, we traversed the fields of biology, chemistry and physics, gradually eliminating the qualitative or teleological element until we finally reached the perfect or limiting form of mechanical causality in which the cause became the antecedent and the effect the consequent; the sole relation between the two being the relation of a less quantity A_1 to a greater quantity A_2. Pure quantitative increase is then the limit or substantial form of relation in the mechanical world or world of Facts. Let us now endeavor to find the limiting form of teleological causality, the relation between Meanings.

Returning to our point of departure, the case of mixed causality or psychical association, we may remember that the process in which the psychical state 'Jacques' called up the psychical state 'Hamlet' (which we expressed in the judgment, 'Jacques resembles Hamlet') was grounded or explicable on a dual relation between the antecedent subject and the consequent predicate. These two types of causal relation are named by psychology Association by Similarity and Association by Contiguity, the former being a case of teleological or final causality; the latter, a case of mechanical or efficient causality. In order to find out just what mechanical causality meant, we were obliged to work downward through the various conditions which governed this particular sequence, regarded on its factual or particular side, until in the course of our process all those teleological elements which permeate the factual order were one

after another eliminated. We have then now to follow the exactly opposite course; instead of gradually eliminating the biological and chemical qualities which taint the space-time world of the factual order with a teleological meaning—a normative significance—which is logically foreign to it, we must now proceed to eliminate the hypothetical and assertorial particularity which taints the non-temporal world of teleological norms with an irrational and mechanical character which detracts from its purity. Indeed this is one of the most noteworthy and remarkable characteristics of the universe—that although the 'world of norms' is diametrically opposed to the 'world of facts,' yet each of these diametrically opposed worlds is tainted and permeated with the characteristics of the other. Biology and chemistry are certainly *factual*, as distinguished from *normative*, sciences, and yet we have seen to what extent they imply the qualitative or teleological element. Just so logic and ethics are distinctively normative sciences, nevertheless they imply as we shall see all sorts of factual considerations. And it is this fact of separation without purity which makes the method of limits the only proper instrument for attaining a comprehension on the one hand of what an Idea or norm really is, and the nature of its relation to other Ideas or norms; and, on the other hand, of what a mechanical or material fact is and its relation to other facts. The Judgment 'Hamlet resembles Jacques' is not a purely normative judgment, that is to say, it does not adequately represent that absolute relation between two meanings which we call Truth. For in the first place there is no such person as Jacques and no such person as Hamlet. They live in a world which does not truly exist, and it is only by my assumption of this make-believe world as a real world that my judgment is true. In short my meaning would be more truly expressed if I said, "If Jacques were real he would resemble Hamlet." This judgment is then a judgment of possibility, and as such its truth is imperfect. We call this kind of imperfect judgment by the name 'Hypothetical,' which means that the relation is not grounded in reality but on a hypothesis. But you will at once reply—Hamlet and Jacques are not merely hypothetical personages, mere empty possibles, a mere possible

is nothing, and obviously Jacques is not nothing but a very important being whom the world could ill dispense with. In fine, Jacques has some sort of actuality as a state of my consciousness and of many consciousnesses, of which Shakespeare's is one. As such then it is more than a hypothetical relation in which he stands to Hamlet. Taking Hamlet and Jacques as states of consciousness it is *really* and not hypothetically true that they resemble one another. But what is the ground of this relation? Is it a teleologically necessary connection, or does it just happen to be what it is? We can conceive Shakespeare to have made a Jacques who would be merry instead of melancholy, and who consequently would not have resembled Hamlet. From this consideration we derive the important conclusion that the teleological similarity of Jacques to Hamlet is itself dependent on certain unteleological brute facts in the temporal world in which Shakespeare lived. Our grounds then for making the judgment are to some extent at least purely factual, and we express this imperfection by saying that the judgment is 'assertorial.' But just as we saw above, that it was unfair to regard the judgment as merely hypothetical for the reason that Hamlet and Jacques were something more than purely possible beings, so here also we must admit that it would be unfair to call the judgment merely assertorial. Hamlet and Jacques are related not merely as facts, but also to some extent as necessary facts. Given the fact that both conceptions involve the character of melancholy, it is rationally or teleologically necessary to admit that they resemble one another. In short I must acknowledge that these semi-hypothetical facts, being what they are, bear a certain relation to each other which I, as a rational being, cannot disregard nor look upon with the indifference with which I have a perfect right to look upon pure matter of fact. A pure fact might be other than it is, but the relation between these particular facts when once they are accepted could not be conceived to be other than rational and necessary. This character of *necessity* makes the judgment in which it is present an 'apodictic' judgment. These three degrees of modality are always to be found in teleological sequences, *i. e.*, sequences whose terms are related in virtue of their common participation in

some third quality. And now that we have shown in a somewhat labored fashion that our chosen example of the mental sequence in which Jacques calls up Hamlet not only contains biological, chemical and physical causality on the mechanical side, but also hypothetical, assertorial and apodictic causality on the teleological side, it will be necessary to study these types of teleological causality in isolation in order to discover the limit approached by the teleological relation as it is gradually freed from the unteleological factors which usually accompany it with the result of obscuring its true nature.

Absolutely hypothetical judgments or judgments about purely possible entities would possess no psychical cogency, would exercise no constraint over the mind of the thinker. An example of such a judgment would be the assertion—"If there is a jaberwock, he would eat a griffin." This judgment exercises absolutely no control over the mind, for two reasons: first, because neither jaberwocks nor griffins exist; and, secondly, because there is no reason for connecting even the bare idea of jaberwock with the idea of griffin-eating. Now take an example of a judgment of the next higher degreee of modality. "If there's a mermaid, she lives in the sea." This resembles the preceding judgment in so far as its subject is unreal, and again in so far as there is no rational connection between subject and predicate—no intrinsic reason for a mermaid's not living in a pond; it differs from the previous judgment, however, in so far as in the quasi-real world of fairyland it has actually been learned from experience that mermaids live in the sea and nowhere else. What is actual for a hypothetical world is hypothetical in a real world. We are actually limited by this judgment, *i. e.*, forced to recognize its cogency whenever we choose to talk about fairyland.

These two types of judgment exhaust the realm of the hypothetical, and we have now to enter on that of the actual or assertorial judgments. And just as we found two degrees of hypothetical judgment dealing respectively with unreal connections, and with real connections in an unreal world, so now we shall find two kinds of assertorial judgments—(1) non-rational or contingent relations between real facts, and (2) necessary

relations between unreal facts. The non-rational between real facts is exemplified in such judgments as "The grass is green," "The rain is falling," "The match is two inches long," "To-day is Tuesday, not Wednesday." These judgments are true, and there is no discoverable teleological ground for their truth. They differ from the hypothetical judgments in that they have absolute cogency over the mind for the moment in which their terms are perceived. They are necessary not for the understanding, but for the sensibility. (The hypothetical judgments only had cogency over the mind on the condition of the mind's voluntarily accepting the hypothetical world.)

The other type of assertorial judgment is not a judgment of fact, but a judgment about determined relations between unreal entities. For example: If a mermaid is defined as a being which if it lived would live in the sea, then the judgment that a mermaid would be able to endure salt-water would have assertorial validity, *i. e.*, cogency over the mind of the thinker as a brute fact in the real world. Or, again, whether any three things A, B and C are real or not, it is nevertheless a fact that if $A = B$ and if $C = B$ then $A = C$, and the validity of this conclusion is absolutely independent of the existence or non-existence of A, B and C. It has, however, assertorial validity and nothing more. The thinker would only have to recall the fact that A and B were creatures of his fancy and all sense of necessity would cease—his judgment would resolve itself into the mere recognition of his consciousness as having a certain form. He finds this character of unity in his consciousness and recognizes its existence in this particular case, just as he recognizes that the grass is green or that to-day is not yesterday. In short, the final test of the degree of modality possessed by any judgment is the amount of the force which it exerts over our actions. The fact that an unreal thing is identical with itself is equal to no more than a simple recognition of an actual relation, whose terms being unreal is itself nothing more than a fact, and as such only determines our actions in so far as they concern themselves with it.

If we now pass to the third and final type of teleological sequence we shall be able to see better the justness of this serial

arrangement of the first and second degrees of modality. We come to the world of necessity in which judgments are neither hopothetical nor assertorial but apodictic. If it be true that possibility, actuality and necessity really stand in a serial order, we ought to be able to predict the nature of apodictic validity from a consideration of hypothetical and assertorial validity. We found that hypothetical judgments could be of two kinds. We could assert a possible relation between possible facts—"a jaberwock would eat a griffin" or "people in Mars have three arms" (and these judgments, exerting absolutely no cogency, could fitly be called 'problematic' rather than hypothetical); or again, instead of asserting a possible relation between possible facts, we could assert an actual relation between possible facts, *i. e.*, "Mermaids live in the sea." The mermaids are to be sure unreal, but the relation between the concept 'mermaid' and the concept 'sea-dwelling' is real though contingent when taken merely as a relation. The hypothetical judgment or the judgment about possibilities concerns itself with relations and not facts. The assertorial judgment or the judgment about actualities concerns itself with facts apart from relations. The fact was either simple, as in the judgment of the grass being green, or complex, as when formed by the actual coexistence or intersection in one consciousness of two purely hypothetical judgments or assertions of mere relation. If the combination of two possibles makes an actual, we should expect that the combination of a possible and an actual, a relation and a fact, would yield a necessary. Let us see if this really happens. A triangle is an actual fact and the relation between the sum of the angles of a triangle and two right angles is a genuine relation, *i. e.*, a relation which is, if not genuinely intelligible, yet more than a mere fact of perception. Hence the judgment, "the sum of the angles of a triangle is equal to two right angles," is a judgment which combines a relation or rule of reason with an actual thing or fact of sense experience, and as such possesses apodictic validity. Now the question arises as to whether there are degrees of necessity. Would there be any meaning in saying that one apodictic judgment was more necessary than another? We have said that the degree of

validity of any judgment was measured by the degree of cogency which it exerted over the mind of the thinker. Hence if we find that several apodictic judgments differ in their cogency, we can admit that there are degrees of necessity. Let us examine the following three judgments: (1) A straight line is the shortest distance between two points; (2) $7 + 5 = 12$; (3) Every event is identical with itself. All these judgments are apodictic, but they possess different degrees of importance. We cannot, indeed, deny the axioms of geometry, but can we not to a large extent neglect them? In so far as our experience is spatial it is dependent upon the laws of space; but a large part of our experience is not spatial and is to that extent independent of the axiom of the straight line. It only possesses cogency over part of the mind. Now the second judgment, like all judgments about particular numbers, involves in itself the whole number series; and as number applies to inner experience as well as to outer, we have in the numerical judgment a greater because a more extensive cogency than in the judgment about the straight line. Finally in the third judgment, the axiom of identity, $A = A$, we have a cogency and consequently a validity more nearly universal than that of either spatial or numerical judgments. For if there is a large part of experience that is independent of the laws of space and a smaller surplus of experience which is independent of number, there would at first glance seem to be no experience at all that is not dependent upon the law of identity. We must then admit that there are degrees of necessity, that apodictic validity may vary in its extent. Hence it will not be enough to say that any apodictic judgment can be regarded as the limit of the series of teleological sequences. To find the limit we must find the judgment which is cogent throughout all experience and not merely throughout particular departments. Perhaps the axiom of identity fulfills this demand for an absolute or universal necessity. To prove this we have only to show that there is no case in which a thing changes its identity. But does not the very statement of the task bring out the impossibility of its attainment? Wherever there is change the law of identity is neglected. A does not remain identical in so far as it gives rise to B. One

thing becomes another thing. We need not take the fact of change as a violation of the law of identity for there must always remain a constant or identical element throughout every change. We have, however, the right to regard change as an example of the limitation, if not the contradiction, of the axiom that $A = A$. Change may imply identity; but identity is not the whole essence of change, and whenever we attend to the changing forms and states of a thing rather than to the thing itself, we are in just so far attending to a phase of experience over which the judgment of identity is not cogent.

Professor Royce in his Religious Aspect of Philosophy gives an example of a judgment which would seem to possess the sort of universal validity for which we have just sought in vain in the judgment of identity. The judgment that 'every doubt implies a reference to an objective truth' is absolutely universal throughout the realm of reason. To deny or to doubt the truth of this judgment is to affirm it, because any rational doubt of the truth of a proposition is based upon the belief that it does not conform to the established nature of things nor to objective Truth, and the existence of this objective Truth is all that the judgment asserted. Before submitting this proposition of Professor Royce's to a final test of the universality of its cogency, we should recall the manner in which the limitations of the previous judgments were manifested. When confronted with the axioms of geometry we could say: There is a portion of our experience over which these laws have no sway. Again in the case of the axioms of arithmetic we could point to the concrete differences in the qualities of experience as being outside the laws of number. Finally in the third judgment we could instance the phenomena of time and change as examples of experiences, the whole nature of which could not be expressed by the principle of identity. We have then, if we would show Professor Royce's refutation of scepticism to be limited in its degree of validity, simply to follow the same path as before, *i. e.*, to find some experience over which the law in question does not hold. The topic of the judgment is itself an indication of its limitation. What are truth and error? They are objects of Reason—the law which binds them together is a law

of Reason. Is there any portion of experience that is not purely rational? Feeling and acting may be reasonable but are they not something more? Every sensation and every act of will contains an element or an aspect which is not reducible to the laws which govern our thought. And in so far as we have experience which is not merely rational, just in so far is our experience independent of Professor Royce's proposition about the necessary implication of a rational doubt. For a non-rational being and for any being in so far as he is non-rational, the judgment in question possesses no cogency nor validity.[1]

The question naturally arises here as to whether there *is* any single judgment the consequences of which we cannot escape by changing or extending our point of view. We may remember that when we arrived in the series of mechanical sequences at what seemed to be a purely quantitative and irreversible change, we found that it was possible by changing our origin or center of mass to view the sequence in reverse order. The only ways in which it was possible to transcend this reversibility or relativity of mechanical processes was by extending the material system until it embraced the entire universe for which there is only one center of mass, or by selecting a system (*e. g.*, an organism) which possessed a *unique* center of mass which could not be exchanged for any other. The case is precisely the same in the present series of teleological sequences. All rational sequences, *i. e.*, all apodictic judgments, seem to be permeated with relativity—there is always some other point of view, as it were, some other center of mass, with respect to which our sequence loses its validity. I can think of only one type of judgment from the consequences of which it is impossible to escape. In the moral judgment or judgment of duty there seems to me no relativity whatever. The judgment that $A = A$ does not forbid us to neglect it in so far as experience is temporal or

[1] If this reasoning be valid, there follows what seems to me to be a rather important result, viz., this: In so far as the arguments used by Professor Royce and Mr. Bradley for the demonstration of the Absolute as a being in whom evil and pain are transcended—depend upon the conclusion that error is transcended—they are baseless. That is to say, there is no inconsistency in regarding God as necessarily rational but by no means either good or happy. The divine transcendence of evil and pain does not follow from the mere transcendence of error.

subject to change. The judgment that every rational doubt implies an absolute truth does not prevent us from neglecting altogether the world of the rational in favor of the world of sense. But the moral judgment that something ought to be not only forbids us to deny it, but it also forbids us to neglect it for anything else. When we stand in the presence of a duty, the moral law does not simply assert its validity or cogency for a single department of experience, it asserts its own apodictic truth and as it were in the same breath it claims our attention and our absolute and peremptory obedience to it. This is the peculiarity of the 'Categorical Imperative,' that in addition to the apodictic validity which it possesses in common with all necessary judgments, it puts in an extra claim to be recognized as more important than anything else. It forbids us to deny its truth, *and it also forbids us to neglect it.* Its cogency is not merely negative but positive, it commands us to vindicate our recognition of its absoluteness by determining our actions in accordance with its maxims. It appeals to us not in so far as we are subject to the laws of space and number, not in so far as we are subject to the Laws of Identity and contradiction, not even in so far as we are rational or sensuous, or social or virtuous. It condescends not at all to justify itself by pointing to any one mode or aspect of our nature. It bids us unconditionally to recognize it and to follow it with all the strength that we have. These attributes of the moral law may be very edifying or they may be the reverse; our interest in the Categorical Imperative is not in the least emotional, we simply cite it as a very peculiar phenomenon and a very significant one for students of epistemology and logic. Its significance is due to the fact that it fulfills the ideal of absolute validity or truth. It is the limit of the series of judgments in which each possessed a greater degree of truth than the one before.

From the problematic judgment which exerted no cogency whatever, and the hypothetical judgment which was valid only if we voluntarily admitted the condition upon which it was based, on through the assertorial judgments whose validity was limited to the moment of perception, up to the apodictic judgment which was absolute through some one department of ex-

perience and finally to the judgment of Practical Reason, which possessed an absolute and unconditional cogency over the entire self—through all this process we have noted the genuinely serial order. Each term of the series, each type of judgment possesses all that the previous terms possessed. And at the end of the process we reach the limiting term, the type of judgment which declares itself as absolute. The moral judgment alone, as the limit of the series, contains in itself the perfect validity to which the speculative judgments could only approximate.

We hear a great deal at present about the judgment of worth as superior to the judgment of truth. Practical Reason is dogmatically asserted to be more real than speculative Reason, and the return to the epistemological dualism of Kant is advocated as 'the only refuge for Theology in its flight from the persecutions of science.' The object of this study in the method of limits is simply an attempt at some sort of justification of Kant's hypothesis of the supremacy of Practical Reason. If one is content with simply asserting that moral truths are superior to the truth of reason, he is helpless against anybody who makes the opposite assertion. If Speculative and Practical Reason are wholly incommensurate the one with the other, there is no criterion for deciding as to the supremacy of either. To assert one as prior to the other is a senseless and arbitrary act. But if we can show that the judgments of the one faculty form a continuous series with the judgments of the other, we vindicate our right to a division into higher and lower. In the light of our analysis it is no longer a paradox to assert the existence of duty as truer than truth. For as we have seen the degree of truth possessed by a judgment is measured by the degree of cogency which it exerts over the mind. The judgment of duty is absolute or unconditional and as such has more cogency than any other possible judgment, hence it possesses a maximum of validity or truth.

Now that we have found the limit of the series of teleological sequences it is necessary to analyze it in order that by observing its inner nature we may be able to see if it is at all commensurate with the limiting type of mechanical sequence. To simplify this analysis I must ask you to assume, without proof,

that the moral law only, or at all events primarily, appears in its own form under certain definite conditions. We use the word 'ought' in a variety of cases in which moral obligation is not felt at all, or if felt, it is only indirectly and by analogy. The three conditions under which the moral law makes its appeal are:

1. The recognition of a good.
2. The immediate possibility of realizing the good.
3. The fact that I and not someone else am the agent for its realization.

We make use of the word ought when any one of these conditions is present; but we only use it in its true and proper, *i. e.*, in its moral sense when all three conditions are fulfilled.

Omit the first condition, and we have the class of what Kant called Hypothetical Imperatives. "I ought to come in out of the rain"—there is no moral obligation contained in this judgment unless I make the further judgment that it is morally good to keep dry.

Again, omit the second condition, *i. e.*, the possibility of action, and we get that class of judgments which express regret or remorse or distress without obligation to act. "My past actions ought to be different." "I ought not to be in this condition." In these judgments I see the impossibility of realizing the good by any action, and with this recognition the obligatory cogency of the judgment of duty is destroyed. And, thirdly, when I say you ought or he ought to do so and so, I fail to perceive the peculiar strain or compelling force of the Moral Imperative. It is only when I realize that there is, first a *good*, which is, second, immediately *possible*, third, for *me to realize* —it is only then, I say, that the judgment of Practical Reason sets up its claim for absolute and peremptory obedience. And I think that if one takes the trouble to analyze his feelings when he fancies that moral obligation is present independently of the presence of all these three conditions, he will find that either on the one hand the apparent obligation will pass away, or on the other hand, he will insist on projecting himself into a world in which the duty in question is possible and possible for

him alone.[1] Granting this we may state the judgment of duty as a judgment in which a possible good is connected with its realization in the world of fact—by means of the *ego*. The cause or antecedent term of the judgment-sequence is an idea; the effect or consequent term is the idea realized or actualized.

We must here note a further peculiarity of the moral judgment. It is self-transcendent in the sense that it refers to something beyond itself, *i. e.*, to its realization in the world of fact. The judgment, "I ought to do this," is only fulfilled or completed in the process of realizing the judgment in action. To recognize or think a duty as binding is only the most rational of judgments when it is accompanied by the specific realization of the good. The moral judgment is truer than the speculative judgment, but the acting out of the moral judgment is the only way to complete or exemplify this truth. Hence this final type of teleological sequence is the change from an idea of a good deed to a good deed. It is the change from the possible to the actual. A is the subject of the judgment, A' is the predicate. A is the idea of the good, A' is the realized fact. A is the antecedent or causal term of the sequence, A' is the consequent term or the effect. A as a possible is the cause of A' as an actual. To find the essence of the sequence we have simply to find the difference between the possible and the actual, the idea of the fact and the fact itself. The effect only differs from the cause in possessing existence. What then is the predicate of existence? As Kant expressed it, How does the actual dollar which will pay a debt differ from the idea of the dollar—which will not pay a debt? That there is a difference between a fact and the idea of a fact we cannot doubt. A man is thoroughly good when he turns his ideas of good into facts; a man is thoroughly bad when he possesses the idea of the good, the knowledge of his duties, but refuses to realize that knowledge. The antithesis between the idea and the fact is of the same kind and of the same degree as the antithesis between conscious sin and

[1] This is what happens in the case of remorse: we either recognize the uselessness of regretting what is necessarily the case and the remorse vanishes, or we persist in projecting ourself into the past circumstance in which the regretted action was not a necessary but a freely chosen possibility.

conscious virtue. The existential predicate is something real, but it is not a quality. We cannot point out any quality which the actual dollar possesses that is not also possessed by the possible dollar. How do we detect the presence of this predicate of existence if it is not visible as a quality? We detect it by its effects, it manifests its reality and its nature in its functions in its relations to other things. The real dollar is known to be different from the ideal dollar because the two stand in different relations to a debt. The one produces certain effects which the other does not, and by the principle of sufficient reason we are bound to explain the visible difference in the effects by positing a genuinely real though invisible and non-qualitative difference in the respective causes. There have been suggested various criteria for distinguishing the external world from the sensations about it.

There is Humes' criterion, based upon the difference of vividness between the real and ideal. This criterion is imperfect in so far as it affords no basis for condemning as unreal or merely subjective the remarkably vivid hallucinations of an insane man. We are driven to adopt a second criterion, the opinions of our fellow-men. What our fellows pronounce actual, that is really actual; and what they say is mere idea or possibility is really so, no matter how vivid it may seem to us. There is to-day an increasing body of thinkers who stop here and accept the verdict of the 'social consciousness' as the final and all-sufficient criterion for distinguishing the real from the ideal. What constitutes lunacy?—simply having an experience which your neighbors do not have. If there were ninety-nine men who possessed in common a certain hallucination, and one man who did not possess it, then we are told that that one man would be insane so far as that community was concerned. It is doubtful if any one could ever seriously believe in this theory, if its necessary implications were clearly seen, and yet like all forms of Berkeley's doctrine of the identity of *esse* and *percipi*, it is a pleasant paradox and one that is easy to defend.

For in the first place, this appeal to the verdict of the Social Consciousness as the ultimate test of what is real, involves an endless and vicious regress. "A thing is real because my

neighbors say it is real." Why do my neighbors say it is real; what is the rational ground for their assertion? According to this theory their only ground must lie in the fact that their neighbors assert the experience as real, the opinions of the latter being in turn justified only by the beliefs of *their* neighbors, and so on until finally we should exhaust the number of men and arrive at the individual who acted as bell-wether to the human flock. Whatever he said was real, that also everyone else would pronounce real. But what would be *his* ground for distinguishing between the real and the ideal? Not the rational (?) ground of 'imitation' because in this first case there would be no one to imitate. We must either admit that in the last analysis the distinction of subjective and objective rests upon pure caprice, or else we must seek a criterion beyond the 'Social Consciousness.' Other men happen not to dream your dreams, but that is not the reason that your dreams lack an existential predicate![1]

There is, however, a third criterion for distinguishing the ideal from the real, viz., the criterion of permanency. When the patient suffering from an illusion refuses to believe his neighbors, he is when possible taken to the apparent cause of his illusion and allowed to test it with other senses than the one affected, upon which the illusion usually vanishes. The part of it which is unaltered by changes in time and in sense remains for him as real. Hence, in general, we may take the common sense view that the *unalterability* of a thing is the final test of its reality.

Now what is the meaning of this word 'Unalterability'? It means what cannot be altered. A man tries to alter an experience and can't succeed. Why? Because the thing resists him; he tries to change it and fails—then he feels safe in pronouncing it real or objective. A baby feels an uneasy sensation

[1] There is nothing mysterious in the seeming plausibility of the Social Consciousness theory, for this plausibility is due to a very simple *hysteron proteron*. A real thing usually shows its reality by being an object for a plurality of subjects, in much the same way and for much the same reason that to a real body in space a number of lines can be drawn. Stand this truth on its head and we get the idealistic doctrine that *because* a body has relations it is real. Relations are at most the *ratio cognoscendi*, but never the *ratio essendi* of existence.

in its finger—finds he can stop it. He also sees the moon and wants it and can't get it. What is the obvious and legitimate induction for the baby to make? Finger sensations, thoughts and gurglings are one kind of thing; moons and cribs and other people's voices are a different sort of thing. The first class belong to me, they are subjective the other class do not belong to to me, they are objective. Why even such a very subjective thing as a pain will if it resist long enough be objectified. The first day of a hard toothache the sufferer speaks of '*my* toothache'; the third day he speaks of 'that infernal pain,' as though it did not belong to him at all.

A thing which resists our will is actual, a thing which does not is possible. We identify that which resists our will with the realm of external experience, because a purely internal thing, like a train of thought, is wholly identified with and amenable to our wishes. The feeling of resistance or of *continuity with something not ourself* is at once the ground of our belief in objective experience as being caused and in subjective experience as being free. There is no sensation so purely possible as not to contain a slight degree of stubbornness or resistance, nor is there, on the other hand, any sensation so intensely actual as not to be in some degree changeable by our will. The property of resistance is then a relative or quantitative affair. It is recognized as akin to our own effort-feeling because it varies continuously and directly with our effort. As in our feeling of effort we get the intuition of pure quantity freed even from the semi-qualitative attribute of extension, so in our intuition of the objective correlate of effort we are likewise compelled to think of a purely quantitative entity. The moral change from the purely possible or practically unresisting *idea* of the good to the actual or practically unalterable good deed is not only the most thoroughly rational and teleological of sequences, but it is also a change from one quantity to a quantity infinitely greater. Existence is manifested in resistance and resistance is a matter of quantity, hence existence is also a matter of quantity. The change from a possible dollar or a possible good deed to an actual dollar or an actual good deed, is a change which involves the addition of an existential predicate, *i. e.*, the addition of an

infinite quantity. We cannot change the possible dollar into the actual dollar, but we can change the possible good into the actual good. But you may answer, Surely the difference between the idea of the good and the fact of good is too fundamental to be explained by a mere increase of quantity. To this I answer by offering an analogy. If we decrease a surface infinitely we reach a line. Now the difference between the line and the plane is of the same fundamental nature as the difference between fact and idea, and yet the conception of an infinite quantitative increase is all that is required to explain the one case. May it not then explain the other also?

The limit approached by the first or mechanical series was the change from a less to a greater quantity, the amount of change being finite. The limit approached by the second series, *i. e.*, the series of teleological judgments is also a change from a less quantity to a greater, though in a perfect moral act the change would be infinite. *The two attributes of the soul are in their essential or limiting forms homogeneous with each other and imply a common substance.*

But the most cursory examination of the act of duty reveals another and equally important characteristic, viz., its perfectly material physical causality. Our actions are quantitative or mechanical in so far as they follow from the intensity of desire, rather than from the quality of the desire. The moral law is essentially and peculiarly material or physical, in that it bids us seek the greatest possible quantum of Good, the maximum of desirability quite regardless of the quality of the object. This is why the good manifests itself in such a variety of objects, though never completely or adequately in any one. Pleasure *qua* pleasant or Beauty *qua* beautiful can never be moral ends. Only what is most desirable and *because it is most* desirable can be recognized as an object of duty.

The moral action then has as much to do with the sensuous and physical as with the rational and teleological, and the realization of an act of virtue manifests its quantitative and spatio-temporal nature in the feeling of effort, to the same extent and at the same time that it exhibits its non-temporal and universal or ideal validity. This double aspect of moral phe-

nomena is evidenced in the use of the two terms 'right' and 'good.' Every moral act is right or rational and at the same time 'good' or 'desirable.' The ethical rationalists or rigorists attempt to restrict ethics to a study of the law of right, the Categorical Imperative. The opposite school of ethical writers —who are in general Hedonists—regard ethics simply as a study of the *summum bonum*. The former claim that the Good or *end* of conduct is deducible from and secondary to the Right, or *law* of conduct. The latter claim that the Right or categorical imperative is deducible from and secondary to the *summum bonum*. The end must justify means is their watchword, while the watchword of the Rationalists is "Let Justice prevail though the Heavens fall." The means must justify the end. The Hedonists forget that the limiting or perfect type of the Desirable must somehow imply the existence of a perfectly right or rational means by which it is to be attained, the Highest Good must be compatible with Right action. The Rigorists on their side forget that the limiting or perfect form of Right must be something more than a merely rational or formal law, and must lead towards the maximum Desirable. To find a single principle of moral action which should in its own simple nature express and harmonize these two opposite *motifs* of our moral nature, upon which the two methods of ethics are based, would constitute the solution of the moral antinomy, the 'masterknot.'

For our purposes it is sufficient to recognize the significance of the moral act as the unique embodiment of a perfectly pure or limiting type of efficient causality, and a perfectly pure or limiting type of teleological causality. When Kant pointed out the Practical Reason as the only clue to the nature of Reality, he discovered a veritable mine of metaphysical wealth,[1] none the less rich from the fact of its all but universal neglect at the hands of his disciples.

From the nature of the moral act as containing in its own

[1] Not least among the many curious and beautiful phenomena of the moral consciousness is the fact which we have foreborne to mention that although the moral act is the only example of perfect efficient causality and of perfect final causality, it is also the only act whose causality is genuinely indeterminate or free. The extent to which a man realizes any given ideal of good is a wholly independent variable governed by nothing in the past or present except itself.

simple and irreducible nature, both efficient and final causality, we can and must infer the nature of the moral agent as a being or substance, which is at once as particular and as material as the *atom* of the physicist, and as universal and intelligible as the *concept* of the logician.

Such then is the nature of the soul. We may call it a 'substance' because it fulfills the three conditions mentioned above as the requisites for a valid concept of substance. It differs from a mere Ding an Sich in that it is known to exist under a form of its own, viz., the moral form; and it stands to its attributes in that peculiar double relation (due to its nature as *limiting type or essence*) whereby it is at once the common genus of both and a distinct species of each. That the soul exists as a substance distinct from matter and mind, yet commensurate with each therein, furnishing the only possible explanation of their interaction, we have seen. We have seen, too, that it is a simple and not a composite substance, for the act of duty in which the soul manifests itself under its own form is a simple act, and not a mere complex of elements. May we ask, in conclusion, as to the destiny of the soul? Does the soul enjoy a genuine immortality, *i. e.*, an individual continuance of consciousness under conditions to some extent analogous to those of time and space? The outlook is extremely sobering and dark. The evidence, when candidly scrutinized, seems to reduce itself to a few ghost stories and a mighty yearning. What indeed does the universe want of an individual's consciousness after death? The world of the physicist certainly does not need it. The dead body in its mere decomposition fulfills satisfactorily all the laws of conservation of matter, motion and energy. Not only is there no need for a 'loose consciousness,' but if there were anything left beside the dead body the symmetry and unity of the physicist's world would seem to be threatened. Nor is the case different with the world as viewed by the transcendental philosopher. An individual consciousness is as far from harmonizing with the Platonic Ideas or pure forms of the panlogist as with the atoms and energy of the materialist. For the individual consciousness, just so long and just in so far as it is individual is permeated with a particularity and contingency

which absolutely defies and sets at naught the attempt to define it in terms of universals. In short, consciousness is in very much the same position as the classical bat, there is no place for it in the empire of the earth, neither in the empire of the air, and condemned to flit helplessly between the two realms, it will ever be as a thorn in the side of the consistent empiricist and materialist and the consistent rationalist and idealist. For what indeed is the individual consciousness but the hybrid product of the union of 'matter' and 'meaning,' of 'facts' and 'values,' of brain cells and 'pure forms'—a thing incommensurate with and wholly different in its nature and processes from the two orders of being with which it deals? Truly an 'epiphenomenon' with respect to either of the two factors from whose union it arises, what right can it possibly have to continue to exist when that union is annulled? And, indeed, modern philosophy when true to itself must answer the question as to a genuine immortality in the negative. We have, it is true, several substitutes for genuine immortality. The transcendentalist doctrine that the *ego* is a timeless fact, and hence not mortal, but possessing nonmortality of the same type as that possessed by the Pythagorean theorem or any other eternal verity. Again, we have the other type of panlogistic 'immortality'—that advocated by Dr. Paul Carus, according to whom, as I understand it, we may hold man immortal in so far as the form or meaning of his life is preserved in the memory of his successors and is influential in moulding history. And, finally, we have the materialist's 'immortality,' which assures us that our real self is the matter of our body and will continue forever.

It seems to me that if we regard the real man as consisting in the matter of his body or the sensational modifications of that matter, or in the timelessly valid ideas with which his intellect deals, or finally and most of all in the mere Hegelistic unity of these two sides of his nature, that we have no right to hope for genuine immortality. But in truth the real man, the *man himself*, is neither matter nor idea, nor both together; the real man is the 'something I know not (thoroughly) what,' which makes possible the extraordinary phenomenon of consciousness, *i. e.*, of the union of the two apparently

incommensurate orders of existence. Nature makes no leaps —there is no action at a distance; and it is simply unbelievable and unthinkable that a bundle of Platonic Ideas and a bundle of brain cells could on their own initiative and without any third thing or medium commune together in the violation of all laws of logic and of physics. And yet they do so communicate. All consciousness bears witness to the fact, and the moral consciousness testifies to the additional fact, that these two phases of being have their true reality, their essential nature in something which is more real than either, viz., the substantial soul. And when consciousness goes out and the universal truths and ideals which swayed the life of the living man return again to their own place, leaving the brain cells again free to follow the laws of inorganic matter—when that event takes place, something will remain, something more real and more precious than what has gone, something that being the condition of consciousness, and having under certain circumstances manifested itself in consciousness, may, under new circumstances, once more feel and think and act.

DISCUSSION AND REPORTS.

THE GROWTH OF VOLUNTARY CONTROL.

Some time ago a series of experiments was conducted by Professor Ladd connected with the voluntary control of the 'Eigenlicht.' Little attention was paid to the results, which were briefly embodied in an article published at the time in the PSYCHOLOGICAL REVIEW. This was somewhat surprising considering the importance of the general principles involved. There can be no doubt that the dominance of the physical explanation of phenomena has reacted to the detriment of our naïve faith in the all-powerfulness of the will. Mechanism has the floor just now. We should be entirely unwarranted, however, in drawing the conclusion that the will and its old-time spontaneity are 'for sale cheap.' The experiments conducted by Professor Ladd showed that the common conclusion is, to say the least, hasty. For the averages obtained, based on an extended series of experiments and conducted, under his direction, by some twenty special students of psychology, revealed the fact that voluntary control, though varying in degree in the particular function in question, as was to be expected, was nevertheless in every case more or less superior to the physical conditions which surrounded the experimenters. We are not, then (for I was one of the experimenters), wholly submerged in the meshes of mechanism.

I propose to trace, briefly, the growth of this fact of voluntary control, especially in connection with the function, illustrated in Professor Ladd's experiments, which the will serves as a mediating term between mechanism and so-called freedom. For I take it that the two statements, 'the will is limited' and 'the will is free,' cannot be reconciled except through the study of the evolution of the mind's progressive self-mastery. The real significance of the will, as an element of psychic life, is to be found, I think, in the way it is occupied in adjusting means and ends, mechanism to freedom. This aspect of volition has not, it seems to me, received the attention it deserves. To present some of the facts connected with this phase of mental life, taken from the psychology of volition, may serve the double purpose of calling attention again to the facts contended for by Professor Ladd

in the experiments above referred to; and also to suggest a new way of approaching the problem of freedom as a psychological factor of noetics and ethics. We may present the subject under the following heads: spontaneous control, or tact; immediate control, or conscious adjustment; teleological control, or self-control.

1. The subject of tact is one of the most mysterious in the whole range of psychology. Here we can only follow out the suggestions given by nature; for the key to the mystery lies in the organic and instinctive activities, the preëxistent factors of which may be taken as affording the clues to the various concrete types of spontaneous control. These are mainly three: (1) One kind of spontaneous control results from a peculiar facility of the will to isolate itself in the developing organism in certain directions to the neglect or indifference of others. We may call this the tact that isolates. Ultimately, this form of spontaneous control rests upon the relationship of the chemical and physiological elements of the vegetative life and the resultant differentiation of organ and function. The will, in some cases, and at some periods always, follows the index finger of nature, and the tact manifested, for example, in the control of the bodily functions, in the progress from infancy to youth, is a concrete illustration of this general fact. Where this species of tact is pronounced, the tendency to control by isolation is continued. The phenomena of genius, in all its forms, depend upon this fact of organic tactfulness for isolation; on this side of it, genius is merely the spontaneous ability to ignore certain directions of possible control for the sake of those which are more spontaneous. Isolation is the physiological condition of self-limitation and it is largely a matter of spontaneity, the will tactfully taking the line of least resistance as the 'rational' line of self-realization. In support of this, it is a fact, well vouched for by physiological students, that certain organs and functions develop more quickly than others and this fact has its corresponding feature in control. In abnormal cases, *e. g.*, abnormal and neurotic children, and children born of parents married late in life, it is frequently observed that the rudimentary organs of the mind, the head and brain in particular, attain to a quicker relative development and are thus isolated for spontaneous voluntary control for the rest of life. This fact, however, if associated with relative stability among the elements, leads to marked character and greatly increased facility of control. (2) The will spontaneously and instinctively controls the changes introduced by *growth* and *experience*. This is another species of tact, viz., the tact for variation. The body, at first in absolute isolation from the world, always shows this tendency

when introduced into its larger environment. But it may also become a specialized form of activity, just as the tendency to isolation does; both isolation and variation are organic; but either may, under appropriate and opportune influences, become voluntary and automatic. In early life, we have doubtless noticed the tendency of the will to make departures in the matter of control. Abnormal and criminal children are cases when this tendency has run to excess. It rests upon the relative instability of the elements of organic life, as well as upon the failure of training. Tact for change, for variation, is a positive gift of the normal individual, however, as these abnormal cases show. The control is spontaneous in this case. No teaching or training seems to be necessary. The child suckles the breast without any previous education and this is a type of the tactful control of variation in all its phases. Further illustrations occur in the voluntary control of the *means* of conscious and teleological control. (3) Isolation and variation are conditions of natural selection; natural selection itself, however, is conditioned on the law of heredity. It is matter of general observation that many of the spontaneous acts of the will are hereditary, *i. e.*, reproduce the features of tact based on preëxistent determination: *e. g.*, the kind of spontaneous control shown by the children of musicians, artists, etc., resembles in kind, though not in degree, the peculiarities of their originals. For all species of tact, and therefore all kinds of spontaneous control, depend on conscious and teleological control, subject to the laws whereby acts are mechanized in habits and temperaments. The notion that the voluntary control itself is a matter of heredity is still unproved. Reflex movements are partially determined by heredity; but tact is more than reflex movement plus heredity; there is a residuum not contained in the chain of organic conditions which is the self-activity of the will itself. Thus, in certain of the arts and crafts, aptitude for the control of tools has become considerably facilitated by the operation of heredity laws. In the Middle Ages, the guilds of workmen exhibited this fact in a very concrete way: generations of the same families continued in the line of service marked out by their ancestry. So to-day in older countries, where the tendency to variation has not entirely overcome the other tendencies, a great part of domestic and industrial life rests upon the spontaneous control of hereditary instincts.

These three kinds of spontaneous control condition all other kinds of voluntary control. Tact constantly broadens as life unfolds; but the development of individuality and character is unfailingly faithful to the type discovered in the earliest spontaneous reactions of the will.

In other words, voluntary control, in its spontaneous form has a modicum of "freedom," and a maximum of "mechanism." The point we make is that freedom and mechanism could not be mediated in any case, not even in the form of tact, without the control of the will, at least in the assenting and instinctive manner peculiar to it. Tact itself is the result of contact, *i. e.*, of the intercourse and inter-play of spontaneity and mechanism. It is, in short, the will that gives to our earliest exertions at control the aspect of experience.

2. There is no marked line between spontaneous and conscious control; the one develops out of the other; the latter bears all the characters of the former. The new factor introduced is the influence of training; for as soon as we leave the phenomena of instinctive and tactful control, we see the necessity of the will 'to take a hand' in all its experience. Now this conscious exertion of will is the main characteristic of the mind of the child. Dim and inchoate are its ideas and but for a rough-and-ready equipment of bodily organs and functions, together with tact in the progressive control of them, everything has to be learned. But a great deal of this conscious control rests upon tact: *e. g.*, the formation of the various areas of reaction in the brain rests upon an organic adaptation in the organs concerned for their particular functions. Take the visual area. This is, mechanically, easily explained; but from the standpoint of voluntary control it is a very complex process, involving adjustment of eye balls, control of muscles and the unique fact of development in the visual area. The same is true of the other so-called 'ideal' sense, hearing. Mechanically organ and function are beautifully adapted; but the will, only after long processes, learns to control this source of perceptions and sensations. To a large extent, tact again explains the difference, *e. g.*, between the organic response of a child to sound stimulation and that of a trained musician. The large interpretative factor in the 'ear' of a Beethoven points to the relatively larger control of the sound impressions. The ear of both, other things being equal and presupposing a normal organ and auditory area, records equally well the stimuli; but only conscious and immediate voluntary control can explain the fact that Beethoven wrote his grandest music after losing control of the mechanism of hearing altogether. But the conscious and progressive control of our organs of sensation is, nevertheless, largely a matter of spontaneity, of tact, dependent upon the large amount of mechanical process involved. And facts go to show that our conscious efforts follow the features of tact already mentioned.

The control of the senses *in combination* is a matter of conscious

voluntary effort, *i. e.*, it is the result of immediate forth-putting of conation. Indeed, when sufficient strength has been obtained, the voluntary control becomes competent to inhibit and even suspend the activities of the bodily mechanism. It is now generally understood that the feelings and the will are intimately related, and that the feelings are closely allied to certain visceral and sympathetic nervous centers. These are under the control of the will, so that, in states of fear, anger, or remorse, or similar more or less complex affective states, the constitutional arrangements of the body may be interfered with. Functional activity, indeed, we regard as subject not only to immediate control, but to teleological also. We train children upon this assumption at any rate: that the spontaneous will to indulge these functions *must* give place to a higher and immediate control. Dirtiness is not only a matter of functional defect; it is a moral affair.

The control of intellection shows, in like manner, a growth of voluntary activity. Language is the greatest achievement of man and to a large extent language is a matter of tact in the form of the so-called imitative will. The conquest of vocabulary, beginning as it does in single words, and extending as intelligence extends, to verbs and relative parts of speech, is based upon experience of the self in its action on the environment. No emergence of intelligence is easy, still less necessary, when the motor centers are undeveloped. Activity again expresses the normal feature of the formation of speech. 'Willie *do* this,' 'Willie *do* that,' shows the mode of self-activity. Always 'do' something. The will must be appealed to and aroused. No word is truer of children and grown men than that they learn by doing. The *order* of volitional control in speech is first the noun. 'Willie' stands for certain associated images of actions; and this is based on previous experience with other concrete objects. Next verbs: 'do' implies the impulsive and imitative will; and this is securely founded upon experience with self in the past and instinctive tactfulness. 'This' and 'that' show the related yet the discriminated thought of purposive action. The complicated phenomena of speech are often amusingly illustrated in the voluntary control of the aspirate. The 'h' is a very active part of speech, and failure to control it is an evidence of failure in motor control, as connected with the imitative use of the will. This is a serious matter in self-consciousness; for it points to volitional instability in muscular and functional reaction. No one can doubt the volitional effort required to control this refractory member, involving breathing, muscular contraction, intellection and conscious and immediate will-power. Some children never control the aspirate. Some nations make havoc of it even.

The control of thought is another and higher step in voluntary activity. Through speech thought is coördinated and knowledge extended. Whether thought exists apart from speech cannot be determined from the introspective standpoint. What we know is that thought develops and comes under the control of the will as speech is mastered; thinking and speaking are the same things on different sides, speech being the volitional expression of thought. *Now no thought bears the aspect of reality which lacks will.* Even the comparatively passive process of sense-perception would be blind without the active presence of the laws of thought; for an object, thoroughly perceived, observed in all its elements, is a thought-object; even the infant's perceptions are, potentially, of this nature. Strictly speaking, of course, thought cannot be controlled, but only followed; but thought is not a matter of experience and knowledge without will, and in so far as the nature of thought becomes a matter for speech, it is entirely under voluntary control, *i. e.*, it is an adaptation of mechanism and spontaneity.

In both these processes, speech and thought, the tact of spontaneous control betrays itself. Generically, this fact may be expressed by the manifestation of peculiar combinations of instincts, feelings and motions in the back ground of thought so to speak. These subjective aspects of consciousness are, however, forms of willing and involve intellection. For we are never *merely* receptive. A feeling, even an organic impulse, is an active state, whether viewed from the aspect of pleasure or pain. The volitional control of feeling is therefore obviously possible, either through the spontaneous activities, or through intellection. There is no affective state which cannot be, to some extent, controlled through these channels. We may thus summon the intellect and emotions to support the will against any attack upon 'freedom.' It is true the intensity of the stimulus, say an intense feeling of pain, cannot be controlled by the will, *i. e.*, cannot be got rid of, or displaced by indifferent mental contents, since the relation of stimulus and reaction is permanent; but all our higher life, all teleological control, rests upon the assumption that the will is not bound by this mechanical relation. For the will's significance in mental life is just this: it is endowed with the function of standing between the mechanical relation of stimulus and reaction and the ends involved in consciousness as a progressive and self-conscious reality.

This voluntary control of intellection can be illustrated in the activity of attention. Attention is a complex operation involving both voluntary and involuntary elements. In a loose sense, primary intel-

lection is a species of spontaneous voluntary control based on reflex-activity; in the simplest act of attention, however, there is involved, something more than reflex-activity, though it is difficult to draw the line between what is mechanical and what is 'free.' The bridge over the chasm between mechanism and freedom is again to be found in the phenomena of progressive control. This control proceeds along two lines. Along one of these we observe a growing power of the will to subordinate the character, intensity, and duration of the sensuous content, upon which so much of what requires attention depends, to ends. This power, primarily, rests, as all else in voluntary control, upon the organic and affective life. We adjust ourselves easily to what greatly excites us. The clearness and degree of absorption in our attentive states, in other words, depend on motor control of the subconscious sort. What is called mind wandering is simply the inability of the will to control the motor side of our mental associations in an immediate and conscious manner: the will flows spontaneously along the stream of suggestion. But training, *i. e.*, the practice to which our organic powers are submitted in contact with suitable environments, soon gives the cure for this state. That cure consists, essentially, in introducing into the stream of sensuous and mental stimulation, the deeper principles of suggestibility involved in control of the teleological sort. Along another line, control is secured in attention through interest. A certain school of thinking to-day, following the isolated suggestions of thinkers as far back as Comenius, says that interest is the alpha and omega of attention. We think not. It is undoubtedly a strong influence: we easily attend to what interests us; but the 'prick' of *sensuous*, organic, excitement is just as strong. The strength of interest lies in the large amount of the self-referring activity involved. *We* are concerned when 'our interests' appeal to our wills. The ego, in the form of feeling, is what we mean by interest; but, for the reason that the ego *is* involved, interest expresses the complex unity of thoughts and volitions which go to make up the total man considered as a person. Interest is thus the total man 'bulging' in the curve of feeling; it is self in the intensest form, self-interest. As such it is almost entirely under the voluntary control of the will. Attention, at any rate, either as sensuously determined or as determined by self-interest, is a growth in which we discover a progressive adjustment of reflex-action to higher and higher modes of self-activity. The phenomena of religious experience, in conviction of sin, repentance and new life, show, as Höffding says, a relative failure of control; but he is entirely wrong in his analysis of humility.[1] The interests which

[1] Outlines of Psychology, p. 244.

we may deem at any time desirable as favoring our private ends are not so high and noble as those which may be contrary to our personal prospects. Egoistic influences, exclusively followed, do not make the demand on voluntary control that those of the more sympathetic type make. So far as attention is concerned, the voluntary control grows, in very few cases, normally, and the types of tact maintain themselves in their concreteness, just as the forms of feeling and temperament remain relatively permanent. The point we make is this: the attempt to resolve interest into exclusive states of feeling, purely self-regarding, and to maintain that it is interest, in this sense, that determines attention, is not a complete analysis of the phenomena of attention. Interest involves a certain instinctive and conscious exertion of the will and so far is not merely a state of feeling. That it also involves representation, in intellection and thought, is obvious when the object of attention is considered. It is nothing against the will that in any particular act of attention it adjusts itself to the prevailing forms of feeling at hand; this is no disgrace, no compromise of freedom; it is the type of all forms of voluntary control. At any rate, the whole of the religious and ethical life proceeds upon the assumption that the will is responsible and free, and what this can mean, if attention is absolutely conditioned on the affective experiences involved in interest, is more than can be understood, at any rate, by the writer.

Immediate and conscious control, then, is a belief which is supported by a considerable array of facts. It will be observed that it starts and abides in instinctive control, or tact; but presents this marked character: the gradual subordination of the mechanism of mental life to its ends. Step by step, the will assumes the power as it is disclosed, and maintains its self-activity by practice until the authority of reason has become possible. In short, we meet with the same phenomenon here as we meet in spontaneous volition, viz., the constant mediating of reflex action and 'freedom.'

3. The same fact is presented in what I have described as teleological control, or self-control in the ultimate sense. The life of man, says Hartley, is a journey from self-interest to self-annihilation. This thought, which is sadly neglected in both psychology and pedagogy, owing to the dominion of physical theories of conduct, plainly implies a progress from a certain aspect of the self to another, with the full consciousness of ends. Not to wrangle on the meaning of the terms, 'self-interest,' and 'self-annihilation,' all will finally admit that the most distinctive characteristic of mind is *activity directed towards ends*. The will, in other words, is teleological. In the first place, it

is so, spontaneously. Tact is a species of semi-conscious adaptation of means to ends. Mechanism is not opposed to purposive selection; it is itself an example of selection, and therefore rests finally on voluntary control. In the case of spontaneous control, the end sought is so largely involved in the operation of the reflex-activities, that the apparent automatic response given bears the outward marks of being purely involuntary. But in so far as ends are proposed will is involved. If the phenomena of tact be resolved entirely into mechanism, it ceases to be a state of the finite consciousness except as re-presented.

The presence of ends in immediate voluntary activity is more readily verified. Synthetic activity is now denied by none but materialists, and so far, therefore, the will in seeking the control of the operations of consciousness is teleological. In specific cases, multitudes of which can be gathered in the class room of any school in the land, the conscious adjustment involved in this fact can be seen. The presence of ends is the light of all mind.

But it is more particularly when the ideals of reason are considered that the full swing of voluntary activity is made known. The will is never 'freer' than when it brings itself under the laws immanent in reason. A lawless will is an abnormality: spiritual principles lie back of all mechanism, and it is one of the glories of man that he can be appealed to on grounds higher than those of self-interest. Now the stable condition of voluntary control which is reached as a result of 'self-denial' for the sake of higher objects and ideals, is the result of conscious adjustment: 'The self' as an immediate object of direct cultivation is brought under higher rational ideals, through the unifying activity involved in all our teleological self-activity. What we call self-control, which expresses both spontaneity and final purpose, is thus the most concrete case of voluntary control. It includes the so-called bodily self, with its mechanical arrangement of organs and functions; it includes the empirical self, and developing intellection; it includes the ideal self, that is, the spiritual self which furthers or hinders all the other processes. In the construction of this self, it is will that plays the controlling part. The feeling about the neck and head, into which some[1] would resolve the consciousness of self, is purely an organic matter, not directly connected with self-consciousness. But 'nature' could appear a unity only for the reason that the will teleologically synthesizes the complex activities of the self; nature has no meaning apart from unifying intelligence, and therefore knowledge would be impossible, even knowledge of the neck- and

[1] Cf. Professor James' Principles of Psychology, Vol. I., 300 p. ff.

head-feelings, apart from voluntary control. The essence of selfhood is this voluntary activity directed by ideals.

In ethics and religion these phenomena are matters of obvious experience.[1] The point we make is that the phenomena of voluntary control are obedient to a general relation, which obtains between reflex-activity and *all* the forms of 'freedom'; that the real question involved is this mystery of control, and not freedom *or* mechanism, as the alternative is usually put.

The relation of these facts to the problem of noetics and ethics is obvious, but too large to be explained in this connection. It is plain, however, that the claim for free intelligence as a constitutive element of knowledge and conduct; the claim that knowledge is impossible without synthetic activity, turns on the implicit acknowledgment or denial of the phenomena briefly presented above. In the experiments conducted by Professor Ladd, briefly referred to, the claim made was that the will not only can, but does, control the physical conditions of intellection. It is true the isolation involved in all experimentation required special conditions, and the purposive choice of means and ends, in the class of facts brought out by him; but the general result was to establish a far greater degree of control than was commonly, or academically, supposed possible. Even making all due allowance for the influence a distinguished teacher is almost always able to exert on the pupils he teaches; making all allowance for the fact that we are liable to see what we *want* to see; the simple fact is (and it is borne out by the psychology of suggestion),[2] that the will has more control and is a more prominent factor in our life-history than current psychology is in the habit of admitting. Whether we look at the spontaneous, the conscious, or the teleological form, we make our own character and destiny; I would go further and say, in the light of the few facts we know, that unknown possibilities of voluntary control are the necessary corollary of the known, and that the future life and human immortality are (in any worthy sense), dependent upon the 'free' adjustment of our souls, in the society of being (the ultimate nature of which cannot exclude intelligent purpose) to God, freedom and immortality.

HENRY DAVIES.

YALE UNIVERSITY.

[1] Cf. Bosanquet, Psychology of the Moral Self.
[2] Cf. Sidis, Psychology of Suggestion.

ETHOLOGICAL PSYCHOLOGY.

In the PSYCHOLOGICAL REVIEW for September, 1899, Mr. C. B. Bliss reviews my pamphlets on Ethology in sympathetic and appreciative fashion. These pamphlets were prepared primarily at the suggestion of one of my colleagues at the University of California and for the purpose of giving the University people some idea of the work I was trying to do. New work is always in great need of both criticism and sympathy. I hungered and do hunger for both. Knowing that my colleagues could find out more about the work if they wanted to, I ventured to pack into a very few pages an amount of material far too great to be clearly set forth in anything less than a good-sized book. As some of the readers of this REVIEW may agree with Mr. Bliss that the work is important, perhaps I may be pardoned if I comment on the impression my work has produced on—may I say—my fellow-psychologists. The history of the terms 'Education as Related to Character' and 'Ethology' cannot well be discussed here; suffice it to say, they have a history and are largely due to local conditions. I certainly have no desire to give new names when they can be avoided.

In a sense, all the sciences that have to do with consciousness may be called psychology. I do not plead guilty to the charge of holding unworthy views of psychology. Unless, however, the social sciences, philosophy, and the study of education must all be called psychology, I cannot agree that the science of the development of concrete character ought to be called a chapter in psychology. If we agree that all the sciences concerning themselves with consciousness should be called psychology, I see no reason why the term 'ethology' should not be changed to 'ethological psychology.' In one sense, geology may be called 'geological physics.'

I am exceedingly sorry if I have given the impression that I regard psychology as 'unsympathetic, mechanical and lifeless.' Such an assertion certainly does not occur in my writings. For instance, I regard the teaching of psychology by my colleague, Professor Stratton, as sympathetic, organic and full of life. Perhaps Mr. Bliss will agree with me that what is *ordinarily* spoken of as 'empirical psychology' does not deal with concrete character, however much it may concern itself with interesting and concrete psychical experience. The other psychological sciences deal with various aspects of our complex character-life; ethological psychology deals with these aspects in their interrelation as functions of actual characters. Hence, for instance,

ethology is particularly interested in the study of scientific biography. Most of my advanced students are working on biography. 'Child-study' is regarded by us as a phase of biography. We try to keep the characters we study 'all of a piece' as far as we can. Hence the necessity of using diagrams. "A science of character must make the whole man significant, must show his development in all its aspects, must integrate the ethological aspects of biological, psychological, social and historical sciences, as well as relate itself to the various philosophical disciplines." In the sentence just quoted I am willing to strike out all of the adjectives qualifying the word 'sciences' except the term 'the psychological.' Ethology would still remain as a chapter of psychology very different in its method and standpoint from all the other chapters.

The 'cone' diagram in my pamphlet is not intended to show all aspects of the subject. Diagrams are like parables; they must not be taken too literally or pushed too far. Not only are we careful in our work not to put too much dependence on mechanical devices; we are also careful to provide ourselves with diagrams that show to some extent the varying value of the different aspects of character. To illustrate: we use a diagram showing the spiral movement in the development of character *from* the predominance of self-assertion, *through* the predominance of religious instincts, *to* the primacy of logical insight. In another diagram we indicate the connection of self-assertion with the instincts or tendencies for play, art and ideality.

As my work at present is in connection with a department of pedagogy, it is natural that I should seem to put too much stress on the school-studies and too little on the influence of authority and personality. Mr. Bliss would not find that fault with the actual ethological work. I meant what I said when the following words were written in the pamphlet on ethology: "Each one of us reflects the universe from his own peculiar standpoint. Each is himself and not another. Each character is unique; particular and universal; social, individualistic and personal. The universe's interests are ours and ours are the universe's. We seek to bring about the society of which each one of us is a member. We seek not the society apart from ourselves, or ourselves apart from the society. So far as we interact with others we are simply natural agents, products and not creators; so far as we *really* coöperate with others, we are creators, and are members of the Kingdom of which God is the Integrator." Indeed, the 'studies' are partial results of character-life, and cannot take the place or even share the place of real living. My 'ethology' would have a poor out-

come if it made me exalt the machinery of education. In an essay recently published (*Love and Law*, San Francisco, 1899) I take strong ground against the dispensation of the 'Hoe with the Man.'

It is only fair to say that our study of ethology is being applied to the school-work. With the aid of Mrs. Frances Bracken Gould, a graduate of the University of California, and a very clear-headed kindergartner, we have been able to see many of our ideas put to the test of practice. Work is also being done on history in the schools, and in other directions.

THOMAS P. BAILEY, JR.

UNIVERSITY OF CALIFORNIA.

SENSATIONAL ATTRIBUTES AND SENSATION.

Professor Calkins, of Wellesley, in the last number of the REVIEW, brings up a topic still much in need of similar discussion by psychologists; it, however, seems to me that she makes her conclusions, demonstrated by excellent arguments, tend in rather the wrong scientific direction, her logic assisting, moreover, the contention of the present writer, namely, that these conclusions do not go far enough.

The very fact that introspection at once belies the common assertion of the best text-books that sensations do have attributes, and this despite the circumstance that by definition they should not have them, would seem to argue that the definition itself is useless, or worse. That the term is, indeed, worse than useless is, in short, the contention of the present writer. No one term in current psychology seems to be more misleading or, as Miss Calkins shows, more illogically used than that of this very concept.

The expression sensation seems to be one that indicates little, if anything, more than a somewhat which if it did exist might serve as a basis for the better understanding of something else, namely, the term feeling. It is as if one precise about technical terms, in teaching psychology should say: You all know what a feeling is—well, imagine all the attributes taken away from feeling and you have a notion of a sensation. Indeed, to current usage, a sensation is nothing more than the unnecessary Ding-an-sich of a feeling, or its logical substance in the Spinozistic sense.

It is not here the place to sketch a history of affective terms as used in mental science, nor is it needful to do so clearly to suggest

that at present this term is ordinarily devoid of meaning. It is hoped that in the forthcoming philosophical dictionary all these terms will be fixed as is best for future scientific usage. It surely is not necessary to keep the term in use in its common sense as defined by Wundt, James, Ladd, Titchener and the rest, for the sake of denoting the inseparable periods of special consciousness which an infant is supposed to have during the first days of his life, nor yet to signify certain rare and almost abnormal experiences had by adults in the so-called 'anæsthesia,' or on awakening from coma. Yet these are almost the only occasions on which a 'sensation' has any objective existence. If we examine into the connotative properties of these periods of consciousness, we find but one, and that deficiency—deficiency of 'quality, intensity, extent and duration,' the so-called attributes of sensation. This Professor Calkins aptly shows. Science has no proper use for terms thus purely negative.

It is, in part, the presence in psychology and in allied branches of knowledge of such concepts as this of sensation that makes the subject so often difficult and confusing to the beginner and frequently so uncertain of expression to the more advanced psychologist. The term sensation is not, like the purely abstract notions common enough in other sciences, denotative of something fundamentally important, but its proper use, as noted above, is very infrequent and relatively insignificant. The terms atom and ether, for example, have for chemistry and physics fundamental importance, for on them, at present, is reared in part the noble structures of these sciences. 'Sensation,' on the contrary, is a relic of a now quite outworn psychology of mind-stuff, and positively misleads therefore in this important regard, while indicating nothing of value as amends. Sensation, as defined and in use to-day, is not the substance out of which is characteristically carved, so to say, a feeling; nor is the sensation buried beneath the feeling, forming its base; but in general the sensation simply is not concerned in the feeling at all: the feeling is feeling all the way through and it is nothing else.

Modern advance toward demonstration of the doctrine of parallelism has done away with any usefulness the term sensation might have (as defined by J. S. Mill, for example), as the immediate concomitant of a bodily change, for feelings as certainly as sensations are now considered to be direct correlates of somatic conditions. For popular use the term still has, of course, reason to exist; our present strictures apply only to the technical usage, when it is important to be exact.

My attack then, is not, like that of Professor Calkins, on the attributes of sensation, but upon the term sensation itself as its most frequent application defines it.

GEORGE V. N. DEARBORN.

HARVARD UNIVERSITY.

AFTER-IMAGES.

In his recently published monograph on 'After-Images,' Mr. S. I. Franz makes with reference to some work of mine a slightly misleading statement. The article referred to appeared in *Mind* for last January, and Mr. Franz implies that its writer while noting the existence of individual variations in the color changes of the image, arbitrarily eliminated them, and that 'her subjects had to be drilled to see a normal image (*i. e.*, like her own).' This way of putting the matter would lead one to suppose that the uniformity of results attained was an artificial one, produced by suggestion: that is, that the subjects were told what I saw, and drilled until they could see the same thing. On the contrary, as the object of the study was to observe the effect of suggestion on the image, I was careful to give no hint to my subjects of my own experiences, during the experiments to determine the normal course of the image. I simply found that while great individual differences existed at first, they tended to disappear in large measure with practice. I quite agree with Mr. Franz that the causes of these variations deserve thorough investigation, but I am inclined to think that one important cause is simply lack of practice in discriminating the image from subjective or other retinal phenomena.

MARGARET FLOY WASHBURN.

WELLS COLLEGE.

PSYCHOLOGICAL LITERATURE.

NEUROLOGY AND PATHOLOGY.

Nevroses et idées fixes. Etudes experimentales sur les troubles de la volonté, de l'attention, de la memoire; sur les emotions, les idées obsédantes et leur traitement. DR. PIERRE JANET. Félix Alcan. 1898. Pp. 492.

In this work Dr. Janet has brought together a number of papers of psychological interest read before various societies, and has added to them a series of chapters based upon studies made upon invalids suffering from various forms of mental disease.

In the introduction he calls attention to the fact that much valuable information for psychologists is to be obtained from the study of abnormal minds, and that no psychological system can be considered adequate which does not take into consideration the disturbances of will, of attention, of memory and of emotion so commonly manifested by the insane.

At the Salpêtrière Dr. Janet had the opportunity of studying many such cases of mental disease especially among the hysterical patients of Professor Raymond, to whom the volume is dedicated. The first fifty pages are devoted to a careful analysis of the mental processes in a young hysterical girl, who manifested a number of fixed ideas. These led in her case to apparent defects of will power, to imperfect power of attention and memory and to abnormal acts of many kinds. The attempt is made to trace these acts and defects to the existence of ideas, present to the subconscious self rather than existing in consciousness. And the proof of this is given in the fact that hypnotic suggestions succeeded in combatting the ideas and thus changing the character, acts and conduct. These fixed ideas seemed to vary in duration and intensity, a fact which Janet implies by the expression *idées fixes stratifiées*, and the most permanent were found more difficult to reach by suggestion than others. A true hysterical explosion seemed to be followed by a clearing away of the ideas and a normal train of thought, and eventually the patient returned to a state of complete sanity after a number of such attacks.

This chapter with its painstaking analysis of this girl's character illustrates well the position of Janet that "experimental psychology

consists above all in mastering the particular subject studied, his life, his temperament, his character, his ideas; and in being convinced that one can never learn enough. It is necessary to place this subject in various given circumstances and notice exactly what he says and does. This method enables us to discover many things which are not without interest for pathological psychology" (67).

In chapter second Janet describes certain results obtained in an attempt to measure the degree of attention and the reaction time of certain individuals, normal and abnormal; his results being about the same as those of other observers.

Chapter third contains a careful study of a patient whose memory of events was suddenly arrested by a shock at a given date and who for nearly nine months appeared to have no memory of things occurring subsequently to that shock, *i. e.*, she lost her power of acquiring new memories. Janet distinguishes this condition from the more common one in which certain memories, as of language, are obliterated by disease; and he shows what a different influence it has on the character. This form of defective memory he names continued amnesia. The subject Mme. D. seemed to see persons and objects, but a moment after failed to recognize them or to have any memory of having seen them. All impressions rolled away and left no trace, even events of importance to her were entirely forgotten at once. An individual may after an accident forget a few weeks of his life but up to the time of the accident his memory was good. An individual of two personalitities under suggestion may forget in state II the events of state I, but when again in state I the memory becomes continuous. But in Mme. D. there was a disappearance of the power of acquiring new memories for this entire period. When, however, she was hypnotized and questioned, she related accurately all the events which had occurred during this period showing the existence of an unconscious memory which was not available on the conscious state. Hence though apparently without memory Mme. D. really was not deprived of memory and her talk during sleep revealed the existence of memories of things about her. She also had a clear memory of things suggested in a hypnotic state, would execute post-hypnotic suggestions. Automatic writing also showed the existence of memory of current events. Janet attempts to explain this condition by separating the power of acquiring memories from the power of reproducing memories acquired. In the case of Mme. D. the latter was defective. It is not enough that a simple isolated sensation should be produced in the mind that it thereby should be perceived. There is needed for com-

plete consciousness of a sensation which is expressed by the words *I perceive*, a second mental operation in addition to the first—not only a personal perception of memories but a psychological assimilation of images (p. 135). And any distraction of the mind is capable of interfering with this process. Hence Janet explains this defect of memory as he does the anæsthesia of hysterical subjects as a limitation of the field of consciousness, a feebleness of the personality incapable of synthetizing all the sensations. The origin of this defect of memory in Mme. D. was a sudden shock, and Janet, believing that this shock was really a fixed idea before the mind causing a distraction, succeeded in curing Mme. D. by modifying her emotional state during hypnosis by suggestions directed to the emotion. Thus all suggestions of return of memory having failed, he suggested certain modifications of the original emotion and thus changed the distraction of the mind by the emotion into a more normal state. As a result the distraction ceased and then memory returned.

Another case was that of a young woman who became possessed of the fixed idea that she was a victim of cholera. All the symptoms followed in a series of attacks, but from each she recovered, remaining, however, completely unequal to any mental or physical effort on account of this prevailing fear. Various attempts in a hypnotic state succeeded in modifying the fixed idea but not in abolishing it. Finally Janet tried to decompose the idea and thus destroy it. "The fixed idea consists of a synthesis of many images, and instead of attacking it as a whole we attempted to transform its elements, substituting one for another and thus to destroy the idea as a whole" (p. 164). The patient had a mental picture of cadavers ready for burial. Janet suggested a certain Chinese general with his robes in place of the cadaver, and then suggested that this figure was alive and walking about, thus removing the fear of the cadaver and of the cholera causing death. But this was not sufficient, and then the attempt was made to substitute for the word *cholera* other words by analyzing its syllables and suggesting others in their place, until finally the word cholera appeared to lose its significance for the patient. She could not recollect it, and it no longer caused alarm. In this way the fixed idea being removed the fear ceased and recovery ensued. There were in this case other secondary fixed ideas which are most interestingly discussed in this chapter, and which in turn finally disappeared.

On the basis of these cases Janet gives, in Chapter V., a *résumé* of the great influence such fixed ideas may play on the mental character of hysterical patients; the idea being sometimes subconscious,

not recognized or known by the patient, yet nevertheless determining the acts and feelings and conduct. The essential feature of hysteria is the existence of these subconscious ideas or representations (Vorstellungen). They are perfectly comparable to post-hypnotic suggestion, controlling action without being conscious. In some cases such ideas may be, however, conscious, develop in spite of the will, and are not under voluntary control. In the majority of cases it is some emotional shock which gives rise to the idea either conscious or unconscious, and hence emotional shocks are the frequent cause of hysterical symptoms.

In the succeeding chapters Janet studies various forms of hysterical manifestations, hemianopsia, allocheiria; contractures and spasms of the trunk with disturbances of respiration, in all of which he shows that the subconscious idea determined the effect, and its removal by hypnotic suggestion resulted in a cure of the symptom. Such cases as he presents in detail with much interesting psychological analysis are familiar to many physicians, and are not at all peculiar to the French. It is, however, unfortunate that in this country patients are far less easily hypnotized in the ordinary manner, although the success of the admonitions of mental healers and Christian scientists, so-called, demonstrate that auto-suggestion has over many minds a controlling influence. It is quite certain that the mental state of calm induced by certain methods advocated by these misguided and ignorant individuals may act as hypnosis acts to counteract states of emotional excitement of a subconscious kind and thus benefit the individual.

Chapter IX. contains a study of a case of insomnia, the remarkable case of a young woman who for two and a half years did not sleep at all, being wakened within a minute of falling asleep by a terrifying idea, the memory of the death of her child. The actual character of this idea she had no recollection of during her waking state; and it was only in a state of somnambulism induced by hypnotic suggestion that Janet succeeded in eliciting from her the memory which caused the terror. By suggestion during hypnotism this memory was disintegrated and she was cured. Janet emphasizes the great influence which subconscious or semi-conscious ideas have upon sleep and its disturbances, a fact only too well known to almost every one practically who has suffered from insomnia. The existence of a fixed idea on the subconscious level is enough to prevent or disturb the condition of the mind necessary to the obliteration of consciousness occurring in normal sleep. Many persons in sleep are really in a state in which the subconscious self is quite awake. Thus a mother may watch her child while asleep, waking at the least movement or cry of

the child yet remaining undisturbed by other far louder noises. Many persons can waken at a given hour. Thus it is evident that subconscious processes may go on during sleep and may modify or prevent it. Such disturbances of sleep as are thus produced must be treated as Janet shows rather by suggestion than by drugs, by removing the fixed idea which dominates the subconscious self and reacts upon consciousness.

Chapter X. contains a study of demoniacal possession in a lunatic and of Janet's success in exorcising the demon by hypnotic suggestion. The analysis of the condition of the patient is most interesting and will well repay the study of every alienist as there are doubtless in every asylum similar cases easily curable if one had the patience to examine the mental characteristics, the method of the development of the delusion, and to obtain control of the individual. The clue to these cases according to Janet lies in discovering the fixed idea, almost always subconscious, which gives rise to their insane acts, and by removing it by hypnotic suggestion. There is incidentally introduced into the chapter an interesting hint regarding the explanation of the acts and revelations of spirit mediums.

Janet ascribes their automatic writing and unconscious statements to the subconscious self open to the suggestion of the individual consulting them and hence responding to him as he may desire.

In Chapter XI. crystal vision is described, and the position taken is that the visions are unexpected involuntary visual memories of the unconscious self which becoming conscious cause surprise, and seem like revelations.

Chapter XII. is of particular interest, as it is devoted to a study of the effect of hypnotism upon the person hypnotized. Janet affirms that after each séance there is a period of exhaustion during which suggestions made become fixed, and then a latent period in which suggestions are active but are gradually fading in intensity, and at the end of this there comes a period of desire to be re-hypnotized with a state of mind in which the patient is very dependent upon the hypnotizer. If not re-hypnotized the original ideas, paralysis, etc., recur. Hence, Janet emphasizes the need of a course of hypnotization in any case of disease rather than the expectation of cure from a single or a few séances. He then proceeds to study the state of mind of dependence which those who have been hypnotized feel, and shows that this state of mind is characteristic of many individuals in the community who need direction by others, and who are thus influenced without being hypnotized. It is the subconscious self which is really reached

and directed by a strong will in the case of these weak persons, and unless it is directed they are unhappy and incapable.

As a study in psychology few recent works can approach this book of Janet's for interest and profit. The one fact which it emphasizes is that character and conduct are the result as much of unconscious as of conscious mental activities, and that no study of individual action, either sane or insane, can be considered complete which neglects both these factors. M. ALLEN STARR.

Nervous and Mental Diseases. H. CHURCH and FREDERICK PETERSON. Philadelphia, Saunders. 1899.

It is not an easy task to write a text-book upon mental disease. The writer should possess considerable knowledge of psychology both of its subjective side and also of the many recent advances in the physiology of the brain. He should, furthermore, have such a practical knowledge of insanity as can only be acquired by its clinical study in an asylum. And lastly it is of no little moment that his literary style should combine clearness and accuracy of thought with a felicitous use of language. Among recent text-books upon Mental Diseases, that of Dr. Peterson seems more nearly to fulfill these conditions than any with which we are acquainted. He has a facility in stating his facts which renders his views easily understood by the the student or by the ordinary reader. He has a thorough knowledge of insanity from long residence in a large institution where his time was not devoted to the petty detail of management but to the study of his patients—and his familiarity with psychology is easily detected on every page.

The book falls naturally into two portions—the study of the symptoms of insanity and the study of its various forms as they are clinically manifest. In the first part the physiology of the brain plays a prominent part, and the unqualified materialistic position is, of course, assumed. This seems inevitable from the medical standpoint, and we cannot but feel that too little importance is given to the subjective side. There are many mental processes which wholly defy physiological explanation such as the formation of delusions, or the permanence of fixed ideas which either subconsciously or consciously control thought and action, and it is the tendency of the materialist to devote his attention to these rather than to the hallucinations or defects of memory which are so much more easily explained. It seems to the writer that too little attention has been given by the author to the writings of the French school, especially to such works as those of Feré and Janet;

and that their theories in regard to the existence of fixed ideas below the level of consciousness which certainly play a large part in the development of certain symptoms of insanity might have been utilized in this section.

Dr. Peterson has avoided very nicely the abyss into which many writers on mental diseases have fallen by refraining from any discussion of the classification of the insanities. The time has not yet come for a classification, as no basis—pathological, clinical, or theoretical—has yet been found. He merely takes pains to give certain classifications of other writers, and then takes up the well-recognized forms of insanity, melancholia, mania, demenoia, paranoia and paresis. These are carefully discussed and well described, and will give a good clinical picture to the reader.

The work can be recommended to the student of psychology and of medicine as a concise and satisfactory text-book upon a difficult subject. M. A. S.

THE EMOTIONS.

La peur et le méchanisme des émotions. Dr. Paul Hartenberg. Rev. Phil., XLVIII. Pp. 113–134. Aug., 1899.

Observations sur le pouls radial pendant les émotions. N. Vaschide. Rev. Phil., XLVIII. Pp. 276–316. Sept., 1899.

Hartenberg's article is written from the point of view which regards an emotion as an interior synthesis of motions. Hence the organic changes which, on the James-Lange theory, are the cause of the emotion, are here considered to be the emotion itself and only the cause of the consciousness of the emotion. This is clearly a pure difference of definition. The distinguishing feature of the author's analysis of the emotional process is the insertion at both its initial and its final stage of a central process of association. The efferent discharge is held to be controlled by a motor image having its center in the prefrontal convolutions, an image whose associative function is to coördinate the various discharges and to mediate between the 'psychic representations' and the 'emotion.' And on the completion of the circuit there is held to be a similar sensory image, situated in the same area, whose function is to combine the impressions received and to connect them with other images. There is here a recognition at least of the coördination of elements in the emotional process, though no distinct recognition of the important problem of their coördination relatively to the so-called 'object.' Unfortunately, so many of the

bodily 'expressions' appear to fall outside of this last coördination altogether and to be mere accidental accompaniments. Moreover, we may at present perhaps still hesitate to accept the views of association centers, on which the author builds his theory, as final. As to the emotion of fear, the only thing noticeable in the incidental treatment here given of it is the testimony against Lange's view of the importance of the vaso-motor phenomena, the fact being pointed out that, while the most constant phenomena in fear are arrested respiration, constriction of the thorax and the feeling of stifling, there is a great deal of individual variation.

Vaschide's investigations have also reference to Lange's theory, in that they deal with one aspect of the relation of emotion to circulation. The particular question studied is the relative frequency during the course of an emotion of the radial pulse. This subject had been already experimented on by Binet and Courtier in the laboratory; the present study deals with it in the case of emotions spontaneously aroused by the experiences of common life. The investigation under these circumstances was naturally one of great difficulty and delicacy, and opinion will probably differ, not only as to the value of the results obtained in any given case, but also as to the conditions under which investigations of this sort are even admirable. The proverbial savant who botanizes on his mother's grave is certainly not more shocking in his devotion to the sacred cause of science than our psychologist who takes his mother's pulse on their first meeting after the death of his father (p. 300), and again at his father's grave (p. 301), and who examines and records his own pulse when alone at the grave, after the emotion had seized him 'avec une fureur et puissance énorme' (p. 307). However, the results are not a little interesting. They go to confirm the experiences of Binet and Courtier, viz., that in all emotions, whatever their quality and tone, there is usually first an acceleration and then a slowing-down of the movement of the heart. Vaschide found this result uniform in all his observations and under all circumstances. The only important difference was that in the strongest emotions of grief, the movement both rose higher and fell less evenly and to a lower point than in the intensest emotions of joy. In emotions of moderate strength there was almost no difference. The conclusion, therefore, is that the pulse alone is no criterion of the quality of an emotion.

H. N. GARDINER.

SMITH COLLEGE.

Ueber den Begriff der Gemüthsbewegung. C. STUMPF. Zeitschrift f. Psych. u. Phys, d. Sinnersorgane. Bd. XI. Pp. 47–99.

The interest of the author in this article is to get the adequate and defensible definition of emotion, rather than to point out the conditions of its origin and development. Though implying the entire affective process, the considerations are limited to those phenomena which are especially regarded as emotions (*Affect*), viz., joy, sorrow, hope, fear, wonder, etc. The positive outcome is rather speedily reached in the preliminary analysis which concludes thus. The peculiar quality of a definite emotion, which constitutes its inner nature for our consciousness, cannot be defined in any manner. The most exact and complete definition can mention only certain rather uniformly recurring marks; but to one, who has never lived through the state, the definition cannot make plain what would transpire in his breast. This need of immediate experience does not forestall an analytical account of the emotional content of consciousness, which admittedly presents nothing new, but confirms the older intellectual accounts given of the emotions. The popular equivalency of emotion and affective process does not aid scientific psychology. There is a recognizable difference between emotion and other feelings, as to intensity, time-rate, ideas, and judgment involved. Emotions do not arise from sensations directly. The sphere of emotion is greatly widened when judgment is integrated in the emotive state. This factor adds no difficulty to the definition. Emotion is also distinguishable from desire. The latter is related to the actual, the former to that which ought to be. In this respect, emotion may be defined as a passive condition of feeling, which relates itself to a judged content. S. insists that a real emotion presupposes a certain amount of mental development, rather than being innate, or given with the biological structure.

The scientific need of pointing out the inner nature of emotion more conceptually, so to speak, has given occasion for the formation of the more modern sensualistic theories. It is supposed that referring to blood and muscle makes the phenomena 'clearer,' because we are more familiar with these in life, than with the intellectual principles of the older theory. It is also supposed that the problems of classification are hereby simplified. The critical portion of the article takes up the theories advocated by Ribot, and by James and Lange. The former regards emotion as only complicated states of the sensuous feelings of pleasure and pain. This theory might have a show of acceptability if judgment, as affecting feeling, could be reduced to mere idea or sensation. Most psychologists to-day reply to this demand in the negative.

The James-Lange theory is not to be identified with that of Ribot, though there is much in common. This view finds the essence of emotion in the peripheral corporeal processes, L. selecting vaso-motor changes, J. the vegetative processes, or visceral sensations. The obscurity of the theory lies, in part, in its general inability to locate the emotion in its exact relation to the sensory stimulation and the attendant organic reflexes. It is shown how the real conception of the theory depends finally upon the psycho-physical principle adopted, since it becomes a question of the casual direction. The state of the discussion of the theory, after fifteen years of defense, is not encouraging. Opponents are more numerous than adherents. The advocates forget that, in spite of all objective and physiological psychology, an opportunity of self-observation must be essential to any attempted definition. The question of the theory cannot be referred to facts, since new facts of emotive reactions are not forthcoming. It remains a question of the power of the arguments. The proof rests on two considerations: Nothing of the emotion remains when we think away all the so-called accompanying phenomena and the corresponding organic sensations; secondly, emotions are produced by purely physical means, even when the representation of objects is entirely wanting, the latter being the chief feature of the older theory. In the first instance, the pathological proofs fail, since the argument supports either the old or the new theory. The proof is robbed of all power by the fact that in anæsthesia, *e. g.*, there is necessarily a reduction and impairment of the intellectual functions. The hypnotic cases tried by Sollier fail in a similar manner.

Besides the particular grounds of proof offered, the two projectors of this theory appeal to certain general principles to support their views. We are presented with the strange spectacle of a physiologist, L., invoking the aid of philosophical monism, and J., a philosopher, putting forth the physiological law of ideo-motor effects, to support the theory. Monistic hypotheses are rejected, however, where psychological observation alone must be admitted in determining a definition. Emotions are something *psychical*, whether the monism becomes physical or spiritual in its logical formulation. The law of dynamogenesis, as interpreted by J., is not fully proven. The factor of the stimulus threshold is omitted. Ideo-motor effects are apparent only when the stimulus has reached a certain intensity. Féré's results on sensation and movement are not conclusive, since they contain too many defects of method. The brain is not a mere tube, through which every drop of the stimulus flows immediately to the

periphery; it is more like a catch-basin. Every sensation does not, fortunately, as shown by Sommer and Herschlaff, necessitate reaction. J's contention must be regarded as a gross exaggeration. Thus the critic proceeds in pointing out the gaps in the progress of the arguments, until it is maintained that there is not a shadow of proof from the standpoint of the theoretical principles dragged into the debate.

Finally, it is shown with some detail, that there are positive grounds of proof against the sensualistic definition. It stands in direct contradiction with the facts of consciousness. According to the theory, all organic sensations should be emotions, which is manifestly untrue. Again, in case the theory were a real interpretation, emotions must be identical in intensity, quality, and time-rate with the sensations through which they become defined. Nothing of these relations are found. J.'s classification into 'coarser' and 'subtler' implies, by comparison, a common, but unnamed, factor which should have been taken as the defining mark of emotive states. The article closes with a recognition of certain justifiable points in the physiological doctrine, and a brief discussion of the nature of apathy as an emotive state.

EDWARD FRANKLIN BUCHNER.

NEW YORK UNIVERSITY.

A Study of Anger. By G. STANLEY HALL. The American Journal of Psychology, July, 1899.

President Hall contributes a very suggestive inductive study of a much neglected subject. A good list of words in the English language bearing on states of anger is given in the beginning. Medical literature and anthropological lore are ransacked for hints and suggestions bearing on the anger psychosis. An empirical, inductive study is then pursued based on the questionnaire method. Cases of spontaneous anger are cited. They may be due to the necessities of growth or over lability of nerve cells or centers. The satisfaction and real physical pleasure that sometimes follow anger suggest that it has its place in normal development. A long summation of petty vexations culminating in a form of erethic inflammation may reach its fulminating stage without any cause assignable by the subject or observable by others. Opposition to the dogmatic habits of a rutty specialization is one of the most frequent of chologenetic agencies. Education is defined, in part, as learning to be most angry with those things that most deserve it and maintaining a true perspective down the scale. Chologenetic agencies are, of course, numerous, such as

personal antipathies based on physical forms and features, aversion to particular acts or automatisms, dress, ornaments, habits, thwarting of expectation or purpose, contradiction, limitations of freedom, pride, justice, etc. Play and mock fights often contain a little repressed anger and are good vents.

The physical manifestations of anger include the vaso-motor disturbances, glandular secretions, salivation, swallowing, nausea, spitting, disturbances of the respiration, various involuntary movements, attitudes and postures, biting, scratching, kicking, etc., etc. The vaso-motor disturbances present a very alluring field for investigation. The very painful cardiac sensations are quite prominent. Letting of blood seems to modify considerably the strength of the anger attack. Menstruation is sometimes arrested. Erethism of the breasts or sexual parts occurs at times. A glandular psychology is mooted. The effect of anger upon the mammary secretions of women is noted. Constipation and diarrhœa are at times the result of irascibility. In two cases a rash, once said to be all over the body, follows every fit of anger in the child. Swallowing, gagging, etc., preliminaries of a fit of anger, are referred to as possible residua of the actions of carnivora as they are about to attack and slaughter their prey. As swallowing is the act of appropriating life-giving food, so the nausea and the antiperistaltic movements of anger mean the repulsion or even the regurgitation of food. By a process of short circuiting and transference of associated kindred meaning the same physical movements accompany a similar mental action or state. Some good hard common sense remarks are made in matters prophylactic and therapeutical which might be taken to heart by those, who by reason of their sentimentality have outgrown their age.

The present reviewer cannot but suggest a few theoretical points of view in reference to the study of anger. The emotions appear to represent the inchoate, uncivilized elements of our lives. They are the Saturnalia of the animal and slave parts of our inherited constitution. As reversions they are subject to some possible explanation. An extension of Hughlings-Jackson's nervous level theory may be of assistance here. With progressive automatization of the various levels in ascending order, consciousness normally accompanies the latest evolved levels. There is apparently maximum of consciousness with maximum of nervous hindrance and nervous expenditure and a minimum of consciousness with a maximum of automatism. In the normal intellectual life the lower levels with their vascular, glandular and muscular subordinated attachments act more or less automatically. At

one time we can easily imagine the whole mental life of our early ancestors was almost wholly absorbed in the reports from these 'serving organs of our nether world.' To-day in unusual circumstances and unwonted contingencies some peculiar stimulus or combination of stimuli, as for instance a physical injury, may set that same nether world of the lower levels in unwonted excitement and the vascular, glandular and muscular combinations of another age may be set in motion and reports thereof, confused and tumultuous, be sent to the present seat of consciousness, the cortex. I can discover in the rougher emotions at least nothing else but disordered masses of sensations from the central and peripheral organs of the muscular, glandular and vascular apparatus accompanied generally by joy or depression. In the emotion of fright, for instance, at an umbrella being opened at my side, I can discover nothing but a mass of disordered sensations arising from the convulsive movements of the muscular mechanism accompanied by vaso-motor sensations arising from cardiac congestion.

Sutherland has well shown the growth of vaso-motor adaptations in the presence of sudden emergencies and unwonted stimuli. Now some of these older adaptations, some of these older coördinations and combinations existing between the nervous system and the motor mechanism of the body may lie relatively dormant or may act automatically and unconsciously. In the civilized life of to-day there may be no need for them to report to consciousness excepting in cases of emergencies. Moreover when they do function they may result in disordered masses of muscular, glandular and vascular sensations owing to the disorder produced by the superimposition of newer and more modern coördinations due to the newer adaptations and to changes made necessary by correlation of growth. Remove the later coördinations, that is, remove the inhibition and control of the later formed associations of ideas and movements and the result is the emotional phenomena of actual warfare, the struggle in all its forms, strikes, holidays, disease, etc.

With the report of every new investigation on the nature of the emotions it is becoming increasingly clear that visceral functioning furnishes the organic algedonic basis of the personality. Some one has said that consumptives generally die happy, but no matter how certain a man's convictions are of a happy immortality, he will never die a triumphant death with disease below the diaphragm.

ARTHUR ALLIN.

UNIVERSITY OF COLORADO.

EXPERIMENTAL.

Ueber die 'Verschmelzung' von Empfindungen, besonders bei Klangeindrucken. EJNAR BUCH. Philos. Stud., XV., 1–66; 183–278.

These articles were first published in Danish as the habilitation address of the author in the University of Denmark. The first is theoretical, containing a criticism of current theories of fusion, especially those of Stumpf, Cornelius, Helmholtz, Wundt, Külpe, and James. He takes up in order the subjects of attention, apprehension or perception (Auffassung), analysis, and fusion proper. The rôle of interest in voluntary attention is illustrated by examples from genetic psychology. The perception of a complex sense presentation is shown to depend upon interest and knowledge of the fusing elements. Then interest and previous experience, as determining the observer's attitude toward the presentation, are found to be important factors in determining the limits of analysis or fusion. His definition of fusion is essentially expressed in the following: We speak of fusion when we encounter a number of stimuli which, in place of each arousing its own sensation as clearly and distinctly as if it appeared alone, produce a combination-presentation or presentation-mass in which a change would take place upon the elimination of one of the stimuli. The avowed object of the research is to determine by experiment whether this fusion is a mental process by itself or is simply the general designation for known influences upon perception.

The second article contains the report of the experiments. The principal apparatus consisted of a series of twenty-three organ pipes with a manometric contrivance by means of which the pipes could be energized with equal force. A variety of combinations of tones were produced by sounding the pipes simultaneously in pairs. The principal tests were made upon nine observers who were simply required to state whether they heard one or two tones. The observers fall into two classes according to the attitude they take toward the presentation. One class of observers attempt to analyze the tone and consider failure to perform the analysis a criterion of fusion. The other observers seem to judge merely by the general effect. This difference in method brings about radical differences in the results, each class however, presenting some common characteristics. Tones at some intervals apart have a greater tendency to fuse than at other intervals. The intervals may be arranged in a series according to the number of times the respective tones fused in these experiments. The author shows by an elaborate analysis of the results that these differ-

ences may be accounted for by the variation of such known factors as consonance, beats between partials, familiarity with certain intervals, etc., and therefore concludes that there is no ground for assuming the existence of degrees of fusion aside from the variation in such factors. In order to check the results, he performed the same experiments using an Appunn 'Tonmesser,' and obtained results that virtually agreed with those obtained with the pipes. Notwithstanding the keen criticism and the careful and elaborate experiments, the author does not arrive at anything essentially new, and the contribution has its chief value in the exposition of his own theory of fusion.

C. E. SEASHORE.

UNIVERSITY OF IOWA.

Neue Untersuchungen über die Zeitverhältniss der Apperception einfacher Sinneseindrücke am Complicationspendel. CHR. D. PFLAUM. Philos. Stud., XV., 139–148.

This is a repetition of Wundt's experiments to determine the direction and extent of disparity in time in the perception of two simultaneous impressions through different senses. The 'Complicationspendel' described in Wundt's Physiological Psychology is employed. A pendulum moves a pointer over a circular scale and rings a gong as the pointer passes any desired number. The observer is required to state at what number on the scale the pointer was when the sound occurred. The author finds that the amount and direction of the displacement vary with different individuals and depend upon the speed of the pointer. He thus reconciles the contradictory results previously obtained by Wundt and von Tchisch by showing that there are individual differences just as in the personal equation in the eye and ear method of astronomers. The maximum difference between individuals in this test is about 0.01 sec. which is much less than the differences found in the corresponding personal equations of different astronomers.

C. E. SEASHORE.

Die Präcision der Blickbewegung und der Localisation an der Netzhautperipherie. CHAS. B. MORREY. Ztsch. f. Psych. u. Physiol. der Sinnesorgane. XX., 317–325.

The author measures the error in the eye-movement, by which we seek to fixate a momentary peripheral stimulus, by the discrepancy between the actual position of an electric spark and the position of a

pointer, placed by the observer at that point of a dimly lighted background, where the spark appeared to be.

After correcting for inaccuracy in placing the pointer, the error of movement is found to increase directly with the distance of the peripheral stimulus from the primary point of regard, and to consist of a constant tendency to underestimate the distance.

The error in peripheral localization is assumed to be identical with the error in the eye-movement.

The results published are based upon single experiments, each for more than 700 different positions of the peripheral stimulus. No measurements are made for movements of less than 8°. The apparent error in the method of designating the terminus of the eye-movement averages half the total error, while for 8° the two are equal. These facts undoubtedly account for the extreme irregularity of the author's curves.

The problem is interesting and important, but the method used is full of complications and probably incapable of giving accurate results. It is doubtful if anything will be entirely successful, except some means of photographic registration.

RAYMOND DODGE.

WESLEYAN UNIVERSITY.

Die Form des Himmelsgewölbes und das Grösser-Erscheinen der Gestirne am Horizont. W. VON ZEHENDER. Zeitsch. f. Psych. und Phys. XX., pp. 353–357.

This paper is supplementary to the earlier article which has already been criticized by the present reviewer in the September number of the PSYCHOLOGICAL REVIEW, page 547. The same errors are committed here as in the first aricle. The author speaks of '*die Volkmann'sche scheinbare Divergenz zweier vertical stehender Parallellinien*' (p. 356), and states on the next page:—'*nur solche Verticallinien paralell erscheinen, die in Wirklichkeit nicht ganz genau parallel sind, sondern* * * * *nach oben ein wenig convergiren.*' As has been pointed out these statements are the exact reverse of the truth.

The other part of the paper is devoted to an effort to show that the apparent flatness of the heavens is a result of '*Tradition*' rather than of connate ideas or of experience. Finally, the apparent variation of the size of the sun and moon is explained by contrast with the apparent angular extension of the sky which is overestimated at the zenith and underestimated at the horizon (again an incorrect statement), although no reason is given why the sun and moon should not

suffer exactly the same sort of false estimation as the sky in these two positions.

CHARLES H. JUDD.

NEW YORK UNIVERSITY,
SCHOOL OF PEDAGOGY.

PHILOSOPHICAL.

Through Nature to God. JOHN FISKE. Boston and New York, Houghton, Mifflin & Co., 1899. 16mo, pp. xv + 195. Price, $1.00.

Mr. Fiske's latest book constitutes the third part of the trilogy initiated in 'Man's Destiny in the Light of his Origin' (1884), and continued in 'The Idea of God as affected by Modern Knowledge' (1885). The earliest work, as it may be apposite to recall, offers a summary account of evolution designed specially to lead up to an avowal of belief in the soul's immortality, not as a provable fact, but as an essential implication of 'the reasonableness of the universe.' The theistic continuation, still basing upon evolution, contains a profession of faith to the effect that "the Infinite Power of which the universe is the multiform manifestation is psychical, although it is impossible to ascribe to Him any of the limited psychical attributes which we know, or to argue from the ways of man to the ways of God." The last little monograph proceeds with the discussion of problems in Philosophy of Religion, and contains illuminating chapters on (1) The Mystery of Evil; (2) The Cosmic Roots of Love and Self-Sacrifice; (3) The Everlasting Reality of Religion.

The first is mainly remarkable for the outspoken way in which it accepts the conclusion so paradoxically put by a younger American thinker—that God is the Devil. In other words, God must be viewed as the author of evil, as well as of what we call good; and the problem is to throw such light upon this unavoidable inference as modern investigation may bestow. The second repeats, with great force and freshness, Mr. Fiske's well-known doctrine as to the part played in the evolving series by the lengthened infancy of the human species of ape, and concludes with an earnest, though dogmatic statement, that the universe exists for moral ends, if any at all. The third defends the reasonableness of the three chief conceptions incident to all religion—the quasi-Human God; the Undying Human Soul, and the value, as a scientific fact (that is, as a *cause* in the process of evolution), of the postulate of the Ethical Significance of the Unseen World. Needless to say, the argument is presented with all the charm that

this author has accustomed us to look for; and, although exceedingly brief, and therefore wearing a certain air of dogmatism, anyone who reads between the lines can note the wonderful range of knowledge it presupposes. It seems to me that, without doubt, similar, if not identical, ideas will be enunciated by some expert in this subject, when the new systematic philosophy of religion, that so many await, makes its appearance.

I have but two criticisms to pass. In the hands of those who know, books of this type can be productive of nothing but good. But, most unfortunately, in the hands of theological reactionaries, whose unconscious hypocrisy is their besetting sin, a sin that takes form in a persistent defence of that for which there is no evidence, I feel sure that Mr. Fiske's outspoken opinions will work widespread harm. It is, possibly, a pity, too, that he has almost repeated the title of Dr. Edwin A. Abbott's striking work (Macmillan, 1877).

R. M. WENLEY.

UNIVERSITY OF MICHIGAN.

The seventeenth volume of the Bibliothèque Sociologique Internationale is *Des Religious Comparées au Point de Vue Sociologique*, by M. Raoul de la Grasserie, who is a judge at Rennes. The subject is one of the first order of importance, but M. de la Grasserie is evidently too much of an amateur in the field of comparative religion for his conclusions to have much weight. His chief authority is a certain M. de Milloné who is not known to fame on this side of the Atlantic at least. 'Cosmosociology' is the name that the author would give to the 'society of God and man' which is religion; he discusses also the 'inter-divine society' of the gods themselves on the lines of the *Iliad;* mortuary religion is not neglected; and the 'organic nature' of religion is brought to the front. The chief value of M. de la Grasserie's work is in occasional classifications like that of 'religious diseases' (pp. 194 +) and such occasional touches as calling the monks 'the specialists of Christianity.' As a treatment of religion as a social force, the book is quite inadequate.—Paris, V. Giard and E. Brière.

N. P. GILMAN.

MEADVILLE, PA.

Spinoza und Schopenhauer. Von Dr. SAMUEL RAPPAPORT. Berlin, R. Gaertners Verlagsbuchhandlung. 1899.

This work is not, as its title might suggest, merely a comparative study of the two systems, but an attempt to determine the character and extent of the influence of Spinoza upon Schopenhauer.

It is a recognized fact that Schopenhauer, like Schelling, Hegel, Schleiermacher and all of the important thinkers of the time, was affected by the pantheist. But the influence might be direct or indirect —either the result of an immediate acquaintance with the works of the pantheist or merely a product of the Spinozistical ideas which were 'in the air' during that period. Our author attempts the task, which is not as simple as it might seem to be, of showing that Schopenhauer was not only early subject to a distinct mediate influence from Spinoza but actually acquired a first-hand knowledge of his works before and during the formation of his (Schopenhauer's) system. This proof is made valuable, and for that matter possible, by reference to the still unpublished MSS. of the pessimist.

The writer also endeavors, in an exhaustive manner, to determine Schopenhauer's opinion of the doctrines and personality of Spinoza.

The work seems to be conscientious and thorough, and as a detail out of the history of philosophy it is valuable. However, it is of interest only to the technical student.

F. KENNEDY.

NEW BOOKS.

A Manual of Psychology. G. F. STOUT. University Correspondence College Press. London, W. B. Clive; New York, Hinds & Noble. 1899. Pp. xvi + 643.

History of Ancient Philosophy. W. WINDELBAND. Authorized Translator, H. E. Cushman. New York, Charles Scribner's Sons. 1899. Pp. xv + 393. $2.00.

The Evolution of General Ideas. TH. RIBOT. Authorized translation by Frances A. Welby. Chicago, The Open Court Publishing Co.; London, Kegan Paul, Trench, Trübner & Co., Ltd. 1899. Pp. xi + 231. $2.25.

Social Laws, an Outline of Sociology. G. TARDE. Translated by Howard C. Warren. New York and London, The Macmillan Company. 1899. Pp. xi + 213. $1.25.

Discourse on Method. René Descartes; Veitch's Translation. Chicago, Open Court Publishing Co. 1899. Pp. vi + 87.

NOTES.

We regret to record the death of the well-known French philosopher, M. Paul Janet, member of the Paris Academy of Political Science and formerly professor at the Sorbonne.

A. Kirschmann, Ph.D., lecturer in philosophy at the University of Toronto since 1894, has been appointed professor of philosophy and director of the psychological laboratory.

Dr. Charles G. Shaw has been appointed to the position in the department of philosophy in New York University made vacant by the resignation of Dr. J. H. McCracken, to accept the Presidency of Westminster College, at Fulton, Mo.

The Regents of the University of Texas have provided a psychological laboratory which has been placed under the charge of Professor Caswell Ellis, of the department of pedagogy.

Mr. Clark Wissler, of the Ohio State University, has been appointed Assistant in Psychology in Columbia University.

S. I. Franz, Ph.D. (Columbia), and G. V. N. Dearborn, M.D., Ph.D. (Columbia), have been appointed Assistants in Physiology in the Harvard Medical School.

R. S. Woodworth, Ph.D. (Columbia), has been appointed Assistant in Physiology in University and Bellevue Hospital and Medical College.

Professor W. H. Squires, who holds the chair of psychology and pedagogics in Hamilton College has been given a two years' leave of absence, which he will spend in study in Germany. W. B. Elkin, Ph.D. (Cornell), Teachers College, Columbia University, has been appointed acting professor.

David R. Major, Ph.D. (Cornell), Teachers College, Columbia University, has been appointed Acting Professor of Pedagogy in the University of Nebraska, Professor G. W. A. Luckey, who holds the Chair of Pedagogy, having been given leave of absence to carry on advanced work at Columbia University.

Professor G. S. Fullerton has returned to the University of Pennsylvania after a year's absence abroad.

Professor J. Mark Baldwin is at present at Oxford (3 Museum Road), where he is revising for the press the MS. of his Dictionary of Philosophy and Psychology. Professor A. C. Armstrong, Jr., is also at Oxford, and Professor G. H. Howison is expected there. Professor William James may also spend part of the winter at Oxford.

DR. JAMES H. LEUBA, of Bryn Mawr College, has compiled a card catalogue of psychology, containing about 10,000 titles. The catalogue consists of the contents of periodicals from 1860–1899. The periodicals selected are not confined to those devoted to psychology, but include many journals such as *Nature*, *The American Journal of Science*, etc., in which psychological articles might be readily overlooked. There are indeed many journals omitted, such as the German physiological archives, but it is hoped that these may be indexed at some future time. Dr. Leuba offers to supply mimeographed copies of the catalogue on standard cards at a price not to exceed $50.00.

INDEX OF SUBJECTS.

Absolute, The, 228
After-Images, 173, 420, 449, 451, 653
Animal Intelligence, 157, 262, 412
Animals, Mental Evolution in, 568
l'Année sociologique, 568
Apprehension, Psychology of, 229, 428
l'Art et le réel, 110
Association of Ideas, 320
l'Asymétrie sensorielle, 562
Attention, 166
Automatic Reactions, 376
Automatism, Social and Imitation Theory, 440

Belief and Will, 150
Breathing, Rates of, and Mental Activity, 164

Cannabis Indica, 153
Child Study, 316, 440
Citizenship and Salvation, 312
Color, Physiology and Psychology of, 162; Illusion, 173
Conduct and the Weather, 539
Consciousness and Organic Processes, 32
Currents of High Frequency, 165

Dynamics of Personal Religion, 484

Education, Cross, 165; Self, 564; of Will, 566
Emotions, The, 540, 660
Ether, Experience under, 104
Ethical, Scepticism and Psychology, 171; System of Adam Smith, 556
Ethics, Visual Instruction in, 327
Ethology, 563, 649
Eye, Reaction-time of, 477; Movement, 667

Fatigue, 203; and Movement, 159; Griesbach Method of determining, 573, 599
Fluctuation of Sensations, 326

Genetic Determination of the Self, 172
God, Conception of, 111
Good and Evil, Studies of, 111.

Hallucinations, 407
Hearing, 667
Heat and Cold Spots, 561
History and Psychology, 1, 148

Illusions, 172, 173, 241, 543, 554
Immortality, Human, 424
Inhibition, 202
Instinct, and Reason, 156, 517; Moral, 216
Instincts of Solitary Wasps, 219
Instinctive Reactions of Young Chicks, 282
Invention, 336

Joy, Emotion of, 540
Judgment, 440

Kant and Helmholtz, 554
Knowledge, Theory of, 432

Laboratory Studies, Chicago, 32; Yale, 196; Clark, 332; Harvard, 376; Iowa, 549
Light-Sense, Professor Müller's Theory of the, 70
Logic, Creighton's, 222

Magic, 564
Memory, Motor, 166; for Absolute Pitch, 514
Memories, Individual, 446
Mental, Life, Physiological Basis of, 159; Disorders, Topical Basis of, 339; Instability, 451; Evolution in Animals, 568
Method, Psychological, 191; Deductive, 444
Mind and Body, Relation of, 232
Mill, J. S., Correspondence of, 440
Modesty, Evolution of, 134
Moral Instinct, 216
Motion, Voluntary, 153
Motor Impulse or Motor Memory, 166
Movement, and Fatigue, 159; Voluntary, 275
Muscular, and Mental Activity, 200; Contractions, Reinforcement of, 201
Mystic Knowledge, 426
Mysticism, 292, 408

Nature, Through to God, Fiske, 670
Nervous and Mental Diseases, Church and Peterson, 659
Neural, Dynamics, 340; Unit, 340
Neurology and Pathology, 654
Neuron, Energy, 341; Activity of the, 453

Neuroses et Idées Fixes, (Janet's) 655

Odors and Tastes, 160
Organic Processes and Consciousness, 32

Pacemaking, 336
Pain, Measurements of, 168
Pathology and Neurology, 654
Perception, Time of, 668
Personality, Human, 310
Philosophy, Problems of, 113
Philosophical, 670
Physiological Basis of Mental Life, 159
Pitch, Memory for, 514
Play, Theories of, 86
Plethysmographic Methods, 195
Psychological, Association, American, 146; Proposed Changes in, 237; Classification, 158; Method, 191
Psychology of, and History, 1, 148; Hindrances to the Progress, in America, 121, 154; Comparative, 157, 262, 282; of Color, 162; of Speech, 164, 319; and Ethical Scepticism, 170; Material versus Dynamic, 180; Postulates of a Structural, 187; of Rhythm, 211; of Peoples, 305; Contemporary, 507, 529; of Invention, 336; Individual, 113, and Collective, 323, and Life, 410; of Apprehension, 229, 428; and the Teacher, 536, 548, 559; Ethological, 563, 649
Psychoses, Dendro-, 332; Hydro-, 333

Reaction-time of the Eye, 477
Reactions, Automatic, 376
Reason, and Instinct, 156, 517; Weir's Dawn of, 327
Recognition, 167; under, Objective Reversal, 395
Religion, Theory of, 298; Dynamics of Personal, 484; Comparative, 671
Reproduction, Accuracy of, 447
Revenge, 221
Rhythm, 211

Salvation and Citizenship, 312
Schopenhauer and Spinoza, 671
Science, Groundwork of, 107
Sensation, 506
Sensations, Fluctuations of, 326
Sensational Attributes and Sensation, 651
Sense, Epithets, 332; Type, Tests for, 174
Sensory Functions of the Motor Cortex Cerebri, 338
Sentiments, l'éducation des, 443
Smell, 557
Social and Ethical Interpretations, 171
Sociology, 533
Soul-substance, 458, 606
Speech, Psychology of, 164, 319
Spinoza and Schopenhauer, 671
Spiritual Content of Life, 92
Spirituality, 554
Subconscious Homicide and Suicide, 199

Taste, 446; and Odors, 160
Teacher and Psychology, 536, 543, 519
Telegraphic Language, 346
Terminology, 444
Tests, Physical and Mental, 174
Time, Sense, 208; Causality and Space, 443; of Perception, 68
Truth and Error, Powell's, 423

Unconscious, Doctrine of the, 445

Vision, 117, 212, 329, 555
Voluntary Movement, 275; Control, Growth of, 639

Weather and Conduct, 539
Will, and Belief, 150; Theory of, 169, Education of the, 225, 566.

INDEX OF NAMES.

Names of contributors are printed in SMALL CAPITALS, and the page numbers of the contributions in **Full Face Type**. In the case of authors reviewed the page numbers are in *Italics* and in case of mention in the notes they are in Roman type.

Adams, B., 239
ALLIN, A., **216**, 443, 664
ANGELL, J. R., 32, **195**
ARMSTRONG, JR., A. C., **107**, *152*, 571, 673

BAILEY, Jr., T. P., *563*, 649
BAKEWELL, C. M., **312**
BALDWIN, J. M., *172*, **568**, 572, 673
Bancroft, C. P., *199*
BARNITZ, D. P., **451**
Baumann, J., *566*
Bethe, A., *340*
Binet, A., *195*
BLISS, C. B., **236**, **322**, **410**, **446**, **563**, *649*
Blondeau, C., *228*
Bloom, S., *329*
Boas, F., 119
Bolton, F. E., *333*
Bosanquet, B., *440*
Bourdon, B., *195*
BREESE, B. B., **202**
Bridel, L., 571
BRYAN, W. L., **346**
Buch, E., *667*
BUCHNER, E. F., **428**, **432**, **440**, **662**

CALDWELL, W., *151*, *171*, **187**, **191**, *332*
CALKINS, M. W., *158*, *443*, **449**, **451**, **506**, *651*
Cantoni, C., 240
CATTELL, J. McK., *159*, *174*, **554**
Church, H., *659*
Cleghorn, A., *201*
Colgrove, F. W., 446
COE, G. A., **484**
Cordes, G., *564*
Creighton, J. E., *222*
Cron, L., *229*
Curtis, H. S., *202*

Davenport, C. B., 571
DEARBORN, G. V. N., *153*, *167*, **199**, **338**, **395**, **453**, **540**, **555**, **568**, **651**
DAVIES, H., **648**
DEXTER, E. G., **539**
DODGE, R., **344**, **477**, **669**
Duprat, G. L., *451*
Durkheim, E., *568*

Ebhardt, K., *211*
Einthoven, E., *543*
Elkin, W. B., 673
ELLIS, H., **134**
Eucken, R., *92*
Everett, W. G., *170*

Fairchild, E. M., *326*
Ferrari, G. C., *113*
Fiske, J. H., *670*
FRANKLIN, C. L., **70**, **117**, *173*, **212**, **329**, **448**
FRANZ, S. I., **446**, **561**, *653*, 673
Fullerton, G. S., 673

Gamble, E. A. M., *557*
GARDINER, H. N., **228**, **310**, **660**
Garten, S., *329*
Gerhardt, C. J., 344
GERMANN, G. B., **599**
Giddings, F. H., *533*
GILLETTE, J. M., **420**
GILMAN, N. P., **671**
Goldschmidt, L., *554*
Grasserie, R de la, *671*
Greef, R., *212*
Griesbach, *573*, *599*
GRIFFIN, E. H., **536**
Groos, K., *86*
Grote, N., 571
Guicciardi, G., *113*
Gutzmann, H., *317*

Haeckel, 239
Hall, G. S., *664*
Hallion, M. L., 239
Hammond, Wm. A., *169*
Hartenberg, P., *660*
HARTER, N., **346**
HERRICK, C. L., **180**
HIBBIN, J. G., *150*, **111**, *113*, **222**, **440**
Herdman, W. J., 340
Hering, E., *453*
Heymans, G., *232*
HYSLOP, J. H., **113**, **292**, *409*
HODGE, C. W., **424**
Hodge, F. W., 119
Hogan, L. E., *316*
Howison, G. H., *111*, 673
Hopkins, A. F., *554*
Horne, P. H., 456
Hylan, J. P., *166*

James, W., *424*, *536*, **572**, 673

Janet, P., 120, 571, *654*
Janet, Paul, 673
JONES, E. C., 229
JONES, J. W. L., 556
JUDD, C. H., *172*, 208, 241, *548*, 669

Keene, A. H., 456
Kemsies, F., *203*, 571
KENNEDY, F., 92, 456, 554, 671
Kiesow, F., 446, *561*
Kirchoff, *339*
KIRKPATRICK, E. A., 104, *153*, 275, 327
Kirschmann, A., 673
Kraepelin, *229*, *203*

LADD, G. T., 121, *154*, *173*, *639*
LEUBA, J. H., 573, 674
Lévy, P. E., *225*
LAY, W., 332
Lloyd, A. H., *312*
Le Bon, G., *305*
Le Conte, J., *111*
Letourneau, C., *568*
Lipps, T., *543*
Lough, J. E., *164*
Lovejoy, A. E., 456

MACDOUGALL, R., *164*, *168*, 191, 203, 317, 320, 564
McGilvary, E. B., 240
Mackintosh, R., 456
Major, D. R., 673
Marbe, K., *215*
Marshall, H. R., *156*, *298*, *517*
Martius, 239
Mendel, 571
Mercier, D., *307*
Meyer, A., 120
Mezes, S. E., 111
Mill, J. S., *440*
MILLS, W., *157*, 262, *412*
Mivart, St. G., *107*
MILLER, D. S., *154*, 232, 423, 456
MONTAGUE, W. P., 458, 572, 606
Moore, G. E., 441
MOORE, K. C., 316
Morgan, C. L., *559*
Morrey, C. B., *668*
Muir, E., *556*
Müller, G. E., *70*
Müller, R., *215*

MÜNSTERBERG, H., 1, *148*, *159*, *292*, 408, *410*

NEWBOLD, W. R., 225

ORMOND, A. T., 426

Pappenheim, K., *448*
Patrick, G. T. W., *549*, *160*
Patten, W., *555*
Paulhan, F., *336*
Peckham, E. W., and G. W., *219*
Pérès, J., *110*
Peterson, P., *659*
Piat, C., 120, *310*
Pflaum, C. D., *668*
Pillon, F., 120
Powell, J. W., *423*

Quantz, J. O., *332*

Ramon y Cajal, *212*
Rand, B., 344
Rappaport, S., *671*
Recejac, E., *426*
Rehmke, J., *232*
Riehl, 239
Royce, J., *111*, 239
Robinson, W. E. *554*

Samojloff, A., *451*
Sanford, E. C., 572
Schaefer, E. A., *338*
Schirmer, O., *117*
Schoute, F., *448*
Schumann, F., *208*
Scripture, E. W., *162*, *164*, *196*
Seailles, 239
SEASHORE, C. E., 336, 667,
Sergi, G., *445*
Seyfert, R., *447*
Shaw, C. G., 673
Sidis, B., *341*
SLOSSEN, E. E., 407
SOLOMONS, L. M., 376
Squires, W. H., 673
STANLEY, H. M., 86, 219, 298
STARR, M. A., 654
Stern, L. W., *428*
Stout, G. F., 239
STRATTON, G. M., 557, 559
Strümpel, L., 456
Stumpf, C., *662*
Sutherland, A., *216*
Swift, J., *448*
Tarde, 119
TAWNEY, G. A., 239, 305, 517
Thomas, P. F., *443*
Turner, J., 344
THOMPSON, H. B., 32
THORNDIKE, E., 282, 344, 412
Titchener, E. B., *187*, 344
TOSTI, G., 529
Triplett, N., *336*
TUFTS, J. H., 533

URBAN, W. M., 110, 336

Vailati, G., *444*
Van Biervliet, J. J., *562*
Van Gieson, I., *341*
Vaschide, N., *195*, *660*
Villa, G., *529*

Wagner, L., *203*
Ward, J., 239
WARREN, H. C., 113, 119, 174, 444, 562
WASHBURN, M. F., *173*, *449*, 653
Weinmann, R., *232*
Weir, J., *327*
Welch, J. C., *200*
WENLEY, R. M., 670
Westermarck, E., *221*
Wissler, C., 673
Witasek, *543*
WOODWORTH, R. S., 307, 673
Worms, R., *322*

Zehender, W. v., *543*, *669*
Ziehen, T., *320*, *432*
Zimmermann, R., 239

BOOKS OF PHILOSOPHICAL INTEREST

EITHER JUST READY OR IN PRESS.

BIOGRAPHY.

BENSON.—The Life and Letters of Archbishop Benson. By his Son. *In Press*

NEWMAN.—Cardinal Newman, as Anglican and Catholic. With Correspondence. A Study by EDMUND SHERIDAN PURCELL, author of "The Life of Cardinal Manning." 2 vols. Cloth. *In Press.*

SPINOZA.—His Life and Philosophy. By Sir FREDERICK POLLOCK, LL.D., University of Oxford. Cloth. 8vo. $3.00.

ECONOMICS, POLITICS, ETC.

BRADFORD.—The Lesson of Popular Government. By GAMALIEL BRADFORD. In two volumes. 8vo. Cloth. 8vo. $4.00.

BROWN.—The Development of Thrift. By MARY WILLCOX BROWN, General Secretary of the Children's Aid Society, Baltimore. Cloth. 16mo. $1.00.

CLARK.—The Outlines of Civics. By FREDERICK H. CLARK, Lowell High School, San Francisco. Cloth. 12mo. *Just Ready.* 75 cents *net.*
A supplement to the students' edition of Bryce's "American Commonwealth."

CLARK.—The Distribution of Wealth. By Prof. JOHN B. CLARK. *In Press.*

EATON.—Government of Municipalities. By the Hon. DORMAN B. EATON. To be Published for *The Columbia University Press.* $4.00.

GIDDINGS.—Democracy and Empire. By FRANKLIN H. GIDDINGS, Columbia University, author of "Principles of Sociology," etc. Cloth. Medium 8vo. *In Press.*

IRELAND.—Tropical Colonization. AN INTRODUCTION TO THE STUDY OF THE QUESTION. By ALLEYNE IRELAND, author of "Demarariana," etc. With 10 historical charts. Cloth. 12mo. $2.00.
By an author who has spent ten years in the tropics in special study of this subject.

OSTROGORSKI.—The Organization of Political Parties. By M. OSTROGORSKI. Translated by FREDERIC CLARKE. Introduction by JAMES BRYCE, author of "The American Commonwealth." *In Preparation.*

PATTEN.—The Development of English Thought. A STUDY IN THE ECONOMIC INTERPRETATION OF HISTORY. By SIMON N. PATTEN, University of Pennsylvania. Cloth. 8vo. $3.00.

RICHMOND.—Friendly Visiting among the Poor. A Handbook for Charity-Workers. By MARY E. RICHMOND, General Secretary of the Charity Organization Society, Baltimore. Cloth. 16mo. $1.00

TARDE.—Social Laws. A Translation of Tarde's "*Les Lois Sociales*" by HOWARD C. WARREN, of Princeton University. With an introduction by J. MARK BALDWIN. Cloth. 12mo. $1.25.

VEBLEN.—The Theory of the Leisure Class. An Economic Study in the Evolution of Institutions. By THORSTEIN B. VEBLEN, University of Chicago. $2.00.

PHILOSOPHY—Mental and Moral.

BALDWIN.—Dictionary of Philosophy and Psychology. Edited by J. MARK BALDWIN, Princeton University. *In Preparation.*

LE BON.—The Psychology of Socialism. By GUSTAVE LE BON. 8vo. Cloth. $3.00 *net.*

ROGERS.—A Brief Introduction to Modern Philosophy. By ARTHUR KENYON ROGERS, Ph.D., Chicago University. Cloth. 12mo. $1.25 *net*

SMITH.—Methods of Knowledge. AN ESSAY IN EPISTEMOLOGY. By WALTER SMITH, of Lake Forest University. Cloth. 12mo. *Ready in September.*
A definition of knowledge and study of the methods by which men have thought it possible to attain it.

SULLIVAN.—Morality as a Religion. AN EXPOSITION OF SOME FIRST PRINCIPLES. By W. R. WASHINGTON SULLIVAN. Cloth. 12mo. $2.00.

Send for the New Announcement List of

THE MACMILLAN COMPANY, New York City.

NEW PHILOSOPHICAL BOOKS

Published by THE MACMILLAN COMPANY

JUST READY.

NATURALISM AND AGNOSTICISM

2 vols. Cloth, $4.00 *net*

By JAMES WARD, M.A., LL.D., Fellow of Trinity College and Professor of Mental Philosophy, Cambridge.

This volume contains the much-talked-of *Gifford Lectures* delivered by Professor Ward in 1895 and 1896.

FROM COMTE TO BENJAMIN KIDD

Cloth $1.50

THE APPEAL TO BIOLOGY OR EVOLUTION FOR HUMAN GUIDANCE. By ROBERT MACKINTOSH, Author of "*Christ and the Jewish Law.*"

Historical and critical—a sketch of the growth of the evolutionary systems of ethics, and a study of their claims to authority.

ETHICS AND REVELATION

Cloth $1.50

By HENRY S. NASH, Professor in the Episcopal Theological School, Cambridge. By the Author of the "*Genesis of the Social Conscience,*" which the New York *Tribune* called "one of the most helpful treatises in the language."

FOR LIGHTER READING.

TRISTRAM LACY

Cloth $1.50

OR, THE INDIVIDUALIST. By W. H. MALLOCK, Author of "*Is Life Worth Living,*" "*The New Republic,*" "*Aristocracy and Evolution,*" etc.

"A witty, incisive, acute satire."—*The Evening Post*, Chicago.

NEW EDITIONS OF

PROF. BALDWIN'S MENTAL DEVELOPMENT

I. **Mental Development in the Child and the Race: Methods and Processes.** With 17 figures and 10 Tables.

"No psychologist can afford to neglect the book."—Professor TITCHENER in *The Dial.*

"Distinguished for its richness of observation, ingenuity of interpretation and originality of experiment."—M. HAVARD in the *Rev. de Met. et Morale.*

II. **Social and Ethical Interpretations in Mental Development.** A STUDY IN SOCIAL PSYCHOLOGY. *Work "crowned" with the Gold Medal of the Royal Academy of Denmark.*

"A piece of close reasoning based on vigilant observation."—*Spectator.*

"No more important work on the psychological foundations of ethics and sociology has appeared for many years."—Prof. S. ALEXANDER.

The continued demand for Professor Baldwin's books will be met by the offer of the two volumes at $3.00 net for the set; or, to accommodate those who already own either volume, singly at $1.75 net each.

THE MACMILLAN COMPANY, 66 Fifth Ave., New York City

YALE UNIVERSITY.

GRADUATE COURSES IN THE DEPARTMENT OF PHILOSOPHY.

I. PSYCHOLOGY AND LOGIC

Elementary Course in Descriptive Psychology, by Professors DUNCAN and SNEATH; Elementary Course in Physiological and Experimental Psychology, Elementary and Intermediate Laboratory Courses, by Dr. SCRIPTURE; Advanced Course in Descriptive Psychology, by Professor DUNCAN; Advanced Laboratory, Technical, and Applied Psychology Courses, by Dr. SCRIPTURE; Course in Abnormal Psychology, by Professor LADD; Course in Logic, by Professors DUNCAN and SNEATH.

II. ETHICS AND PHILOSOPHY OF RELIGION

Elementary Course in Ethics, in which the psychology of the moral nature will be specially considered, by Professor LADD; History of Modern Ethics, by Professor SNEATH; Philosophy of Religion, by Professor LADD.

III. PHILOSOPHY AND HISTORY OF PHILOSOPHY

Introduction to Philosophy, by Professor LADD; Philosophy and Literature, and Philosophical Anthropology, by Professor SNEATH, Philosophical Discussions—a course in philosophical criticism—by Professor DUNCAN; Theory of Evolution, by Professor WILLIAMS; Readings in Philosophy, by Dr. GREEN; Philosophy of Mind, by Professor SNEATH; Philosophical System (Hegel's Phänomenologie des Geistes), by Professor LADD, History of Modern Philosophy (especially from Descartes to Kant), and a Course in Epistemology (historical and critical), by Professor DUNCAN; Pre-Socratic Philosophy, and the Metaphysics of Aristotle, by Dr. STEARNS.

IV. INTRODUCTORY AND COGNATE COURSES

Courses in Biology, by Professors SMITH and CHITTENDEN; Courses in Anthropology, Social Science, etc., by Professors SUMNER and BLACKMAN, are open to the students of this department.

The Philosophical Club meets once a fortnight. It affords an opportunity to the students of the department to discuss special philosophical subjects; also to hear addresses and papers from distinguished authorities.

For Catalogue and further particulars, address

Professor ANDREW W. PHILLIPS,
Dean of the Graduate School.

The University of Chicago.

PSYCHOLOGY: Two continuous courses, one introductory one research work, in Experimental Psychology, with thorough laboratory facilities, Assistant Professor Angell. Advanced Psychology: selected problems and theories, Assistant Professor Angell. Courses in Comparative Psychology and Methodology of Psychology, by Assistant Professor Mead. Three Courses, by Associate Professor Loeb, in the department of Physiology, take up the physiology of nerves, senses and central system; Six Courses, by Head Professor Donaldson, in the Department of Neurology deal with the architecture, histology, growth of nervous system and brain, and localization of function, etc Three Courses, by Dr. Thomas in the Department of Sociology, deal with folk-psychology.

LOGIC AND METAPHYSICS: Philosophy of Nature, by Mr. Mead; Seminar in Problems of Metaphysics, based on comparative study of Spencer, Bradley and Lotze, by Head Professor Dewey; Seminar in Logic (1899–00) by Mr. Dewey.

ETHICS: A Two Years' Course in the Theory and History of ethics, by Mr. Dewey. [This is omitted for 1898–99; the history will be given in 1899–00.]

ÆSTHETICS: One Course in Theory of Interpretation and Criticism, by Mr. Dewey; One Course in History of Æsthetic Theory, by Associate Professor Tufts.

HISTORY OF PHILOSOPHY: General Course in History of Philosophy, by Mr. Tufts; Seminar in Kant, by Mr. Tufts; Seminar in Mediæval Philosophy, by Mr. Mead; and (in 1899–00) Seminar in the Development of Greek Thought, by Mr. Mead; and in either Continental or English Philosophy, by Mr. Tufts. Courses are also given by Dr. Shorey, in the Greek Department, in Greek Philosophy.

All the courses mentioned above are Graduate Courses. Undergraduate and graduate work, not included in the foregoing statement, is given in the regular summer quarter. The department issues a series of philosophical publications. For information regarding the Summer Quarter, for complete program of department, and for information concerning fellowships, address **THE EXAMINER, The University of Chicago.**

University of California.

PSYCHOLOGY. Five courses: (1) General Psychology; by Associate Professor STRATTON and Dr. MOORE; the other courses by Associate Professor STRATTON, namely: (2) Introduction to Psychological Experiment; (3) Psychological Conference,—selected topics, in their historical setting, and as treated by present-day writers; (4) Laboratory Psychology,—problems for practice with apparatus and in methods, assigned individually; (5) Advanced Psychology,—problems in laboratory research, assigned individually.

LOGIC AND THEORY OF KNOWLEDGE. Five courses: (1) Formal Logic, deductive and inductive, with emphasis on practice, Dr. MONTAGUE and Dr. MOORE; (2) Inductive Logic, with especial reference to criticism of the empiristic philosophy of logic, Dr. MONTAGUE; (3) Advanced General Logic,—criticism of Lotze, Bradley, and Bosanquet [to be omitted 1899–1900], Dr. MONTAGUE; (4) Theory of Knowledge,—criticism of leading theories, aiming at a constructive result, Dr. MONTAGUE; (5) Seminary in Logic and Theory of Knowledge,—unsettled and new questions [to be omitted 1899–1900], Professor HOWISON.

HISTORY OF PHILOSOPHY. Four courses: (1) European Philosophy in Critical Outline, Dr. MOORE; (2) Plato and Aristotle,—a comparative criticism [in 1900–1]; (3) Scholastic Philosophy [in 1900–1]; (4) The Philosophy of Kant,—exposition and criticism, Dr. MONTAGUE.

ÆSTHETICS. Three courses: (1) Poetics, based on Aristotle's *Poetics*, Lessing's *Laocoön*, and Freytag's *Technique of the Drama*, Associate Professor LANGE, of the department of English; (2) Literary Criticism,—a study of Æsthetics and Comparative Literature, Professor GAYLEY, of the department of English; (3) The History of Æsthetics, Professor GAYLEY.

ETHICS. Two courses: (1) General Ethics, including Civil Polity,—history and criticism of its theory, Dr. MOORE; (2) Ethical Theory as set forth by Cicero,—based on the *de Finibus*, Professor MERRILL, of the Department of Latin.

METAPHYSICS. Two courses: (1) Seminary in Hegel,—the *Wissenschaft der Logik* and the *Encyclopädie*, with search for solution of Hegel's unsolved problems of Personality [in 1900–1]; (2) Philosophical Seminary,—topics changed yearly [to be omitted 1899–1900], Professor HOWISON.

The Philosophical Union holds monthly meetings. It issues occasional publications, of which two volumes have appeared from the press of The Macmillan Company: *The Conception of God*, by Professor JOSIAH ROYCE and his critics; and *Christianity and Idealism*, by Professor JOHN WATSON (in the first edition only).

For Annual Announcement and further particulars, address

JAMES SUTTON,
Recorder of the Faculties, BERKELEY, CAL.

Columbia University in the City of New York.

University Courses in Psychology, 1899–1900.

I. INTRODUCTION TO PSYCHOLOGY. Two hours weekly.

A. PROLEGOMENA TO PSYCHOLOGY. Six lectures. Professor BUTLER.
B. PHYSIOLOGICAL PSYCHOLOGY. Eight lectures. Dr. FARRAND.
C. EXPERIMENTAL PSYCHOLOGY. Eight lectures. Professor CATTELL.
D. GENETIC PSYCHOLOGY. Seven lectures. Dr. THORNDIKE.
E. COMPARATIVE PSYCHOLOGY. Seven lectures. Professor BOAS.
F. PATHOLOGICAL PSYCHOLOGY. Three lectures. Professor STARR.
G. GENERAL PSYCHOLOGY. Eight lectures. Professor HYSLOP.
H. PHILOSOPHY OF MIND. Six lectures. Mr. STRONG.

II. EXPERIMENTAL PSYCHOLOGY, INTRODUCTORY COURSE. Two hours weekly. Professor CATTELL.

III. EXPERIMENTAL PSYCHOLOGY. Laboratory work. Two or four hours weekly. Professor CATTELL, assisted by Mr. WISSLER.

IV. PROBLEMS IN EXPERIMENTAL PSYCHOLOGY. Two hours weekly. Professor CATTELL. The subject of this course is altered each year.

V. RESEARCH WORK IN EXPERIMENTAL PSYCHOLOGY. Daily. Professor CATTELL, assisted by Mr. WISSLER.

VI. GENETIC PSYCHOLOGY. Two hours weekly. Dr. THORNDIKE.

VII. GENERAL PSYCHOLOGY. Three hours weekly. Mr. STRONG.

VIII. DISEASES OF THE MIND AND NERVOUS SYSTEM. Lectures and demonstrations. One hour weekly. Professor STARR.

IX. PHYSIOLOGICAL PSYCHOLOGY. Three hours weekly. Dr. FARRAND.

X. ABNORMAL AND PATHOLOGICAL PSYCHOLOGY. One hour weekly. Dr. FARRAND.

XI. RESEARCH WORK IN PHYSIOLOGICAL AND ABNORMAL PSYCHOLOGY AND IN ETHNOLOGY. Daily. Dr. FARRAND.

XII. PHILOSOPHICAL SEMINAR. Topics in the History of Psychology. Two sessions each month. Professor BUTLER and Dr. JONES.

University Courses in Departments related to Psychology.

PHILOSOPHY. Eight Courses are offered by Professor BUTLER, Professor HYSLOP, and Dr. JONES.

ANTHROPOLOGY. Six Courses by Professor BOAS and Dr. FARRAND.

EDUCATION. Twenty Courses by Professor BUTLER and the Faculty of the Teachers College.

ZOÖLOGY. Eleven Courses by Professor OSBORN, Professor WILSON, Dr. DEAN, Dr. STRONG and Mr. CALKINS.

PHYSIOLOGY AND ANATOMY. Eighteen Courses by Professor CURTIS, Professor LEE and Professor HUNTINGTON.

PHYSICS, SOCIOLOGY, DISEASES OF THE NERVOUS SYSTEM, etc., are fully represented by University Courses.

Further particulars will be found in the Announcement of the Division of Philosophy and Psychology, which may be obtained from the SECRETARY of the University.

University of Pennsylvania.

Graduate Courses in Philosophy, Ethics, Psychology and Pedagogy, 1899-1900.

A. Philosophy and Ethics.

1. History of Modern Philosophy. Professor Fullerton.
2. Epistemology. Seminary. Professor Fullerton.
3. Analysis of Ethical Theories. One Term. 2 hours. Seminary. Assistant Professor Newbold.
4. The Factors of Conduct. One Term. 2 hours. Seminary. Assistant Professor Newbold.
5. Aristotle's Metaphysics. Seminary. Assistant Professor Newbold.
6. German Idealism. Dr. Singer.
7. Contemporary English Thought. Dr. Singer.
8. Development of Scientific Thought. Dr. Singer.

Courses 1, 2, 6, 7 and 8 two hours weekly for one academic year.

B. Psychology. Assistant Professor Witmer.

1 and 2. Physiological Psychology. Sensation and Perception. 2 hours.

3 and 4. Complex Mental Processes. Experimental Psychology. 2 hours.

5. Modern Psychological Theory. 1½ hours.
6. Selected Themes in Experimental Psychology. Laboratory. 1½ hours.
7. Seminary in Child Psychology. 1½ hours.
8. Individual Laboratory Work.

C. Pedagogy. Professor Brumbaugh.

1. Institutes of Education. 2 hours.
2. History of Education. 2 hours. (Omitted 1899–1900.)
3. Educational Systems and Ideals. 2 hours.
4. Educational Seminary. 1 hour.

The courses in Philosophy and Ethics are arranged in a three-year cycle. Ten courses in addition to these are planned for the subsequent years.

Fellowships and Scholarships.

The University offers to graduate students thirty (30) Scholarships, including free tuition only, and thirty-eight (38) Scholarships and Fellowships, yielding free tuition and from $100 to $800 in cash.

For information, apply to

William Romaine Newbold,
Dean of the Department of Philosophy (Graduate School),
University of Pennsylvania,
Philadelphia, Pa.

Harvard University.

Courses in Philosophy for 1899-1900.

LOGIC. Professor ROYCE: 1. Introductory Course; 2. Seminary in Logic and Epistemology.

PSYCHOLOGY. Professor MÜNSTERBERG: 1. Introductory Course; 2. Laboratory Research; 3. Seminary. Dr. McDOUGALL: Experimental Course. Professor EVERETT: Psychology of Religion.

METAPHYSICS. Professor ROYCE: General Course. Dr. D. S. MILLER: Philosophy of Nature. Professor EVERETT: Theism and Religious Philosophy.

ETHICS. Professors SANTAYANA and ROYCE: General Course. Professor PEABODY: Social Questions. Professor PALMER: Seminary. Professor PEABODY: Seminary on the Christian Social Order.

ÆSTHETICS. Professor SANTAYANA: General Course.

HISTORY OF PHILOSOPHY. Professor PALMER: General Course. Professor SANTAYANA: 1. Greek Philosophy; 2. Seminary in Aristotle. Dr. MILLER: 1. Descartes, Spinoza, Leibnitz; 2. Locke, Berkeley, Hume. Professor PALMER: Kant. Professor EVERETT: 1. Comparative Religion; 2. Seminary in Kant and the Ritschlians.

COURSES IN EDUCATION FOR 1899-1900. Mr. NORTON: History of Theories and Practices. Professor HANUS: 1. Educational Theory; 2. School Organization; 3. Foreign School Systems; 4. Seminary on Contemporary Problems. Professor PARKER: The Teaching of the Classics.

For a pamphlet giving full description of these courses, apply to the SECRETARY OF THE UNIVERSITY.

The Religion of Science Library

A Collection of standard works of The Open Court Press, issued bi-monthly. Yearly, $1.50; single numbers, 15, 25, 35, 50 and 60 cents (9d., 1s. 6d., 2s., 2s. 6d., 3s.), according to size. The books are printed on good paper, from large type.

The Religion of Science Library, by its extraordinarily reasonable price, will bring a number of important books within reach of all readers.

The following have already appeared in the series:

No. 1. **The Religion of Science.** By PAUL CARUS. 25 cents.
2. **Three Introductory Lectures on the Science of Thought.** By F. MAX MÜLLER. 25 cents.
3. **Three Lectures on the Science of Language.** By F. MAX MÜLLER. 25 cents.
4. **The Diseases of Personality.** By TH. RIBOT. 25 cents.
5. **The Psychology of Attention.** By TH. RIBOT. 25 cents.
6. **The Psychic Life of Micro-Organisms.** By ALFRED BINET. 25 cents.
7. **The Nature of the State.** By PAUL CARUS. 15 cents.
8. **On Double Consciousness.** By ALFRED BINET. 15 cents.
9. **Fundamental Problems.** By PAUL CARUS. Pages, 373. 50 cents.
10. **The Diseases of the Will.** By TH. RIBOT. 25 cents.
11. **The Origin of Language,** and **The Logos Theory.** By LUDWIG NOIRÉ. 15 cents.
12. **The Free Trade Struggle in England.** By GEN. M. M. TRUMBULL. 25 cents.
13. **Wheelbarrow on the Labor Question.** 35 cents.
14. **The Gospel of Buddha.** By PAUL CARUS. 35 cents.
15. **Primer of Philosophy.** By PAUL CARUS. 25 cents.
16. **On Memory,** and **The Specific Energies of the Nervous System.** By PROF. EWALD HERING. 15 cents.
17. **The Redemption of the Brahman.** A Novel. By R. GARBE. 25 cents.
18. **An Examination of Weismannism.** By G. J. ROMANES. 35 cents.
19. **On Germinal Selection.** By AUGUST WEISMANN. 25 cents.
20. **Lovers Three Thousand Years Ago.** By T. A. GOODWIN. 15 cents.
21. **Popular Scientific Lectures.** By ERNEST MACH. 50 cents.
22. **Ancient India: Its Language and Religions.** By H. OLDENBERG. 25 cents.
23. **The Prophets of Israel.** By C. H. CORNILL. 25 cents.
24. **Homilies of Science.** By PAUL CARUS. 35 cents.
25. **Thoughts on Religion.** By G. J. ROMANES. 50 cents.
26. **Philosophy of Ancient India.** By RICHARD GARBE. 25 cents.
27. **Martin Luther.** By GUSTAV FREYTAG. 25 cents.
28. **English Secularism.** By GEORGE JACOB HOLYOAKE. 25 cents.
29. **On Orthogenesis.** By TH. EIMER. 25 cents.
30. **Chinese Philosophy.** By PAUL CARUS. 25 cents.
31. **The Lost Manuscript.** By GUSTAV FREYTAG. 60 cents.
32. **A Mechanico-Physiological Theory of Organic Evolution.** By CARL VON NÄGELI. 15 cents.
33. **Chinese Fiction.** By the REV. GEORGE T. CANDLIN. 15 cents.
34. **Mathematical Essays and Recreations.** By H. SCHUBERT. 25 cents.
35. **The Ethical Problem.** By DR. PAUL CARUS, 35 cents.

THE OPEN COURT PUBLISHING COMPANY,
324 DEARBORN ST., CHICAGO, ILL.
LONDON: KEGAN PAUL, TRENCH, TRUEBNER & CO.

Courses in Philosophy Open to Graduate Students in Princeton University (1899-00).

1. ETHICS. Theoretical and practical ethics, the foundation of moral obligation, the will, conscience, the nature of virtue, and the moral law. Recent ethical discussions. Lectures. Senior Required; first term [2].* The President. *Calderwood:* Handbook of Moral Philosophy.

5, 6. (LATIN 13, 14.) Lucretius, De Rerum Natura, and Cicero, De Natura Deorum. Senior Elective; both terms [2]. Professor PACKARD.

7, 8. THEISM. Senior Elective; both terms [2]. The President.

9. SCIENCE AND RELIGION. The history and the logic of the sciences with reference to emerging problems of religion. Graduate course; second term [2] Professor SHIELDS. Lectures.

---

3 I. HISTORY OF ANCIENT PHILOSOPHY. Greek and Roman Philosophy to close of Pagan Schools. Given 1897–98, alternating with 3 II. Junior and Senior Elective; first term [2]. Professor ORMOND. Lectures. *Zeller:* Outlines of Greek Philosophy; *Windelband:* History of Philosophy.

4 I. HISTORY OF MEDIEVAL PHILOSOPHY, embracing the patristic and scholastic periods and ending with Francis Bacon. Given 1897–98, alternating with 4 II. Junior and Senior Elective; second term [2]. Professor ORMOND. Lectures, with references to *Ueberweg, Erdmann, Windelband.*

3 II. HISTORY OF MODERN PHILOSOPHY. Philosophy from Descartes to Kant. Given 1896–97, alternating with 3 I. Junior and Senior Elective; first term [2]. Professor ORMOND. Lectures, with references to *Falckenberg.*

4 II. HISTORY OF MODERN PHILOSOPHY. Philosophy since Kant. Given 1896–97, alternating with 4 I. Junior and Senior Elective; second term [2]. Professor ORMOND. Lectures, with references to *Falckenberg.*

The courses 3 I, 4 I, 3 II, 4 II furnish a continuous course of lectures on historical philosophy running through two years.

6. EXPERIMENTAL PSYCHOLOGY. Introduction to the subject. The method, scope, and most general results of the experimental treatment of the mind, considered especially in its connection with general psychology, education, and medicine. Special demonstrations, in the laboratory, of the psychology of movement and sensation. Junior Elective; second term [2], Professor WARREN and Dr. ————. *Sanford:* Course in Experimental Psychology.

8. (GREEK 10.) The Protagoras of Plato, and lectures on the Platonic philosophy. Junior and Senior Elective; second term [2]. Professor ORRIS.

9. INDUCTION AND THEORY OF LOGIC. Senior Elective; first term [2]. Professor HIBBEN. Lectures.

10. SYMBOLIC LOGIC AND THEORY OF PROBABILITY. Senior Elective; second term [2]. Professor HIBBEN. Lectures.

11. (GREEK 13.) Aristotle, the Nicomachean Ethics, with prolegomena and dictations. Senior Elective; first term [2]. Professor ORRIS.

* Numbers in brackets indicate hours per week.

13. ELEMENTS OF EPISTEMOLOGY. Lectures. Senior Elective; first term [2]. Professor ORMOND. Collateral reading.

14. METAPHYSICS. Lectures. Senior Elective; second term. Lectures [2]. Collateral Reading. *McCosh:* First and Fundamental Truths.

15. PHYSIOLOGICAL PSYCHOLOGY. Lectures and laboratory work on the anatomy and physiology of the nervous system; the main problems and results of Physiological Psychology. Senior Elective; first term [2]. Professors BALDWIN and MCCLURE, and Mr. DAHLGREN.

16. THE PSYCHOLOGY OF LOGIC. Senior elective; second term [2]. Professor WARREN.

17. EXPERIMENTAL PSYCHOLOGY. A continuation of course 6, although independent in its topics. The psychology of the special senses (sight, hearing, touch, etc.) experimentally treated. Senior Elective; first term [2]. Professors BALDWIN and WARREN. Lectures, demonstrations, and practical work required of all students in this course.

18. EXPERIMENTAL PSYCHOLOGY. Detailed treatment by lectures and demonstrations of the measurement of mental intensities (Weber's law) and of the results of mental chronometry. Senior Elective; first term [2], Professors BALDWIN and WARREN and Dr. ———. References: Wundt, Külpe, Jastrow, Cattell.

19, 20. GENERAL PSYCHOLOGY. Advanced course. First term: Senses and Intellect; second term: Feeling and Will; with consideration of abnormal mental conditions. Senior Elective, open to graduates; both terms [2]. Professor BALDWIN. *James, Höffding, Ladd, Baldwin.*

21, 22. SELECTED TOPICS IN PHILOSOPHY. Graduate course; both terms [2]. Professor ORMOND. Lectures.

23, 24. (GREEK 15, 16.) Plato; analyses of his dialogues, lectures on his philosophy, reading of the Phædo and parts of the Republic. Graduate course; both terms [1]. Professor ORRIS.

25, 26. EXPERIMENTAL PSYCHOLOGY. Consisting largely in research work. Graduate course; both terms [2]. Professors BALDWIN and WARREN and Dr. ———.

27, 28. MODERN AND CONTEMPORARY PHILOSOPHY. Graduate Seminary; both terms [2]. Readings, discussions and theses. Professor ORMOND.

29, 30. GRADUATE PSYCHOLOGICAL SEMINARY. Both terms [1]. Professor BALDWIN. Subject for 1898–99: Social and Genetic Questions.

31. THEORY OF MENTAL MEASUREMENTS. Graduate course; first term. Professor WARREN.

32. OUTLINES OF PHILOSOPHY. A Course in the Encyclopedia of Philosophy. Graduate Course; both terms. Professor ORMOND. Lectures, with collateral reading.

33. Theories of Heredity and Descent. General treatment by lectures of the important questions in Evolution. Senior Elective and Graduate Course. Second term [2]. Professor BALDWIN.

For regulations, respecting degrees, etc., see the University Catalogue; also for courses in such cognate subjects as Neurology, Sociology, Art, etc.

Enquiries may be addressed to any of the professors in the Department.